SEP 23 1916

VOL. LXXIX. No. 2023. [All Rights Reserved.] SEPTEMBER 1, 1916. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE FOURPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. SUBSCRIPTION per annum, Postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 2s. 10d. ($5.80); to all other countries, 30s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie Etrangère, 22, Rue de la Banque. Telegraphic Address: "Ageekay, London." A B C Code. Telephone Nos. City 997; Central 4425 (Editorial only).

MOULDED INSULATORS
Of all Descriptions.
LITHOLITE, Ltd.,
55-57, Hackney Grove, London, N.E.

FURNACES for WHITE METALS, &c.
(Hall's Patents),
Without Oxidation. Automatic Heat Control.
Enormous Saving in Residue.
Easy payments arranged in special cases.
Monometer Manufacturing Co., Ltd.,
ASTON, BIRMINGHAM.

"FIVE IN ONE"
INDUCTION MOTORS.
WRIGHT & WOOD, Ltd.,
HALIFAX.

COOPER HEWITT LIGHT.
24 hours' daylight. Write for List No. 278.
THE WESTINGHOUSE COOPER HEWITT CO., LTD.,
80, York Road, London N.

BROOK MOTORS.
See Advertisement, Sup. 30.

SWITCHGEAR.
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors,
GREENLAND PLACE, CAMDEN TOWN, LONDON.

TAYLOR & CO.
MICA & MICANITE
Speciality :—Plates for high resistance.
TELEPHONE :—CENTRAL 4575.
40, HATTON GARDEN, LONDON, E.C.

EVERY DESCRIPTION OF
SMALL TURNED PARTS and CASTINGS for ELECTRICAL ENGINEERS.
A. MORTON,
6, Tenby Street North, Birmingham.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

Have your Feed-Water Tested Free of Charge, by the . . .
"ECLIPSE" BOILER COMPO CO.,
6, Bristol Bridge, Bristol.
SOLE MAKERS OF INFALLIBLE COMPO FOR PREVENTING AND REMOVING INCRUSTATION IN STEAM BOILERS.
AGENTS WANTED.

"EMPIRE"
AUTOMATIC CONTROL
FOR
Shell Presses, Compressors, Machine Tools.
ELECTRIC CONTROL, LIMITED, GLASGOW.

WESTERN-ELECTRIC
COMPANY, LIMITED,
Norfolk House, Victoria Embankment, W.C.
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement last week, Sup. 23.

CONNOLLY BROS., Ltd.,
for
WIRES AND CABLES.
See Advertisement this week, p. iii.

WHITE
Electrical Instrument Co.
2, 4, & 6, GLOUCESTER ST.,
CLERKENWELL, LONDON, E.C.
Wire: Voltograph, London. 'Phone: City, 8660.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

INSULATING BEADS
Immediate Delivery.
HOLDER-HARRIDEN LTD., 35|37, Noble St., London, E.C.

CABLES AND WIRES.
SWITCHBOARDS.
ARC LAMPS.
JOHNSON & PHILLIPS, LTD.,
CHARLTON, LONDON, S.E.

AIR COMPRESSORS & VAC. PUMPS, Desiccators Sets.
NORMAN DICKSON, PRINGLE & CO.
Cable Pumps & Impregnators.
25, Victoria St., Westminster.

LARGE STOCK KEPT FOR QUICK DELIVERY
SHUNT REGULATORS,
MOTOR STARTERS and all classes of Resistance Work.
The SOLENOID REGULATOR Co., Highgate Sq., Camp Hill.
Telephone: Midland 582. BIRMINGHAM Telegrams: "Solenoid, Birmingham."

BLANKS. PIERCING.
STAMPINGS
METAL.
HAROLD, HARLEY & Co.,
Harley Works, Beckton Road, London, E. 'Phone: East 1300.

STONE'S ELECTRICAL INSTALLATIONS for RAILWAY CARRIAGES.
50,000 COACHES EQUIPPED ALL OVER THE WORLD.
J STONE & COMPANY, Ltd.,
Deptford, London.

THERMIT, LIMITED,
675, COMMERCIAL ROAD,
LONDON, E.
'Phone: EAST 4157. 'Grams: "Fulmen, Step, London."
PATENT
Alumino Thermic Welding Process.

VICTORIA DYNAMO & MOTOR CO.,
CRAVEN HOUSE, KINGSWAY, LONDON.
Send for Stock List of Motors ready for delivery.

INGLEBY & CO., LTD.
ELLAND ROAD, LEEDS.
MOTORS FOR DIRECT AND ALTERNATING CURRENT
Tel. 378
Delivery from Stock up to 50 H.P.

Advertisement Index, see page xxiv

EDISWAN EVERYTHING ELECTRICAL

THE EDISON SWAN ELECTRIC CO., LTD.,
PONDER'S END, MIDDLESEX.
'PHONE: 520 ENFIELD.

FULLY LICENSED UNDER BRITISH PATENTS Nos 2151/05-2713/05 AND OTHERS.

Callender's C.T.S. Cables
for Insulation & Sheathing

Callender's Cab Tyre Sheathed Cables are insulated with pure and vulcanized india-rubber of the highest suitable quality procurable, and finally sheathed overall with patent Cab Tyre Rubber, thus ensuring the maximum of efficiency.

This Cab Tyre Sheathing is not affected by corrosive moistures, and will stand very hard wear.

Our descriptive booklet gives full particulars!

Pat No 3996 1911

Callender's
Victoria Embankment, London, E.C.

NANTERRE BATTERY CARBONS.

SPECIAL CINEMA CARBONS.

Agents for British Isles: **WELLS ELECTRICAL CO.,** 73, CHEAPSIDE, LONDON, E.C.

Telephone: 4117 City. Teleg.: "Elcharbelo, Cent. London."

SCOTLAND: W. M. Wilson & Co., 18, Waterloo Street, Glasgow.

Manufacturers—COMPAGNIE FRANÇAISE DE CHARBONS POUR L'ÉLECTRICITÉ.

BASTIAN METERS

FOR DIRECT CURRENT ONLY.

Made in ENGLAND with BRITISH CAPITAL & BRITISH LABOUR.

Buy the cheapest and most efficient meter on the market from:

THE BASTIAN METER CO., Ltd.,
Bartholomew Works, Kentish Town, N.W.

TELEPHONES

PATENT. LOUD SPEAKING. WATER-TIGHT.

ALFD GRAHAM & Co.,
CROFTON PARK, S.E.

ADOPTED BY THE BRITISH ADMIRALTY, MANY FOREIGN GOVERNMENTS, & THE LEADING STEAMSHIP LINES.

FOR SHIPS, MINES, POWER STATIONS, ETC.

VULCANISED FIBRE.

In Sheets, Rods, Tubes, and Special Shapes.
Horn Fibre, Diamond Insulation Press Board, Fuller Board, &c.

DIAMOND FIBRE TRADE MARK

DIAMOND STATE FIBRE CO., 57, OLD ST., LONDON, E.C.

THE
ELECTRICAL REVIEW.

VOL. LXXIX. SEPTEMBER 1, 1916. No. 2,023.

ELECTRICAL REVIEW.

Vol. LXXIX.] CONTENTS: September 1, 1916. [No. 2,023.

	Page
Welfare Work	225
Identifying the Enemy Trader	226
Pig Lead	226
The B.A. on the Tyne	227
Science and Research	227
Switchboards for Polyphase Testing, by A. T. Bullen (*illus.*)	228
B.T.H. Turbo Air Compressors (*illus.*)	229
The Johannesburg Municipal Electric Power Station (*illus.*) (*concluded*)	231
L. & N.W. Railway Electrification (*illus.*)	234
New Electrical Devices, Fittings and Plant (*illus.*)	235
Legal	235
War Items	236
Reviews	238
Business Notes	239
Notes	242
City Notes	245
Stocks and Shares	245
Market Quotations	246
Petri Peregrini Maricurtensis, by P. F. Mottelay	247
The Niagara Power Situation	247
The Industrial Conditions in Germany in War Time	249
Correspondence—	
Cab Whistles and Lamp Calls	251
The Deficiencies of Government Departments	251
The Electrical Heating of Factories	251
To Go—or Not to Go?	251
Foreign and Colonial Tariffs on Electrical Goods	251
New Patents Applied for, 1916	252
Abstracts of Published Specifications	252
Contractors' Column	Advertisement page xx

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MELBOURNE: The Mining & Engineering Review, 99, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

J. A. Berly's).

1916 EDITION.

H ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

WELFARE WORK.

"AMONG all the changes which the great war has brought in its train, none is more significant, and none more likely to have lasting effect than the revolution in the structure of British industry. . . . The factories are alive with new workers; the State assumes new responsibilities; fresh needs and opportunities arise; industrial conditions are in solution."

With these words Mr. Lloyd George commences a foreword to a book on "Welfare Work"—employers' experiments for improving working conditions in factories—by Miss E. D. Proud, B.A., which has just been published; and they form by no means an exaggerated picture of the extraordinary conditions which now obtain in British industry. Nothing less than a world-war that shook the British Empire to its very foundations could have brought about changes so vast and so unprecedented, or could have induced our workers to divest themselves, even temporarily, of the rights and privileges which, as the result of years of industrial strife, they had succeeded in wresting from their employers, and even in placing on the Statute Book. Who, before the war, could have conceived, by the wildest flight of imagination, that an army of women would one day be engaged in manufacturing shells by the million, or that, as was recently stated, 14,000 women would be employed in general engineering work other than shell making on the Clyde alone? The volume before us in itself is a remarkable production—the work of a woman, a graduate from an Australian University, who has made an intimate study of the conditions of "welfare work" in factories, and possesses a knowledge of the subject of unique extent and understanding. The fact, too, to which Mr. Lloyd George calls attention, that it is out of the manufacture of weapons of destruction that the opportunity to humanise industry has arisen, is another singular feature of the situation, recalling the riddle with which Samson perplexed the Philistines: "Out of the eater came forth meat; and out of the strong came forth sweetness." "The effort now being made to soften asperities, to secure the welfare of the workers, and to build a bridge of sympathy and understanding between employer and employed" may leave behind "results of permanent and enduring value, to the workers, to the nation, and to mankind at large," says Mr. George. So may it be.

In itself, of course, welfare work is no new thing; it has been practised in isolated instances for years, even for generations, and the fact that it is not only socially, but also commercially profitable, has been recognised in many quarters. But never before has

it been taken up so generally and so earnestly, and the State, though it has set up what Miss Proud defines as a "minimum objective standard" by factory legislation, has hitherto confined its efforts to such requirements as can be regarded as essential to the maintenance of the health and to the preservation of the life of the workpeople, without attempting to secure for them greater physical and mental comfort or to increase the efficiency of their productiveness. Now, however, when the Government has become by far the greatest employer of workers in the State, and also controls thousands of privately-owned concerns, whilst the necessity for securing the highest possible efficiency of production has become imperative, entirely new conditions have arisen, and we are glad to add that the Government has fully recognised the new responsibilities that it has incurred.

The Departmental Committee appointed to consider the question of the Health of Munition Workers has issued a series of reports which will prove of permanent value; some of these have already been dealt with in our columns. Financial assistance has been afforded, to enable employers to provide canteens, cloak-rooms, rest-rooms, lavatories, &c., and the importance of welfare work has been so fully demonstrated that a new department of the Ministry of Munitions has been created to secure a high standard of conditions for all workers in munition factories, and the training of "welfare supervisors" has actually become the subject of special courses at several Universities.

To review Miss Proud's book adequately in the space and time available would be an impossible task; it constitutes so thorough and exhaustive a treatise that, as Mr. George remarks, it bids fair to become the standard work on the subject. It first deals with the history and development of the efforts made by employers to improve the working conditions of their employés, and of the legislation to which they gave rise—for it was largely to the initiative and support of the mill-owners themselves that factory legislation was due. One of the earliest discoveries made by certain manufacturers was that a reduction of the long working hours then in vogue actually led to increased output, a fact which has been re-discovered in connection with the manufacture of munitions of war. The importance of distinguishing between philanthropy—which the workers resent—and real welfare work, which they feel to be their due, is emphasised by the authoress; justice, not charity, or even the suspicion of charity, must be the foundation. In the second part of her book Miss Proud treats in detail of the actual conditions and methods obtaining in factories, wages and hours, the necessity of rest and recreation, sanitation and housing, mental development, regard for the dignity and self-respect of workpeople, and matters of organisation. In every section she displays a mastery of her subject, a breadth of view, and a judicial balance of mind which impress the reader with the value of her treatise, and we most cordially commend this timely work to the attention of all employers and works managers.

Identifying the Enemy Trader.

It will be remembered that in the early months of the war some of the popular newspapers, and many of their and our correspondents, inspired no doubt by the worthiest of motives, and anxious to clear out thick layers of Teutonic influence from the Augean stable of British trade, sometimes allowed their zeal to get the better of their discretion. All and sundry who were suspected, or whom the writer wished, or thought he ought, to suspect, were open to attack. The slowness of the Government Departments in coming into line with public opinion and fully recognising the necessities of the case, was in some measure responsible for this tendency, and no doubt the more recent progressive policy of the Government has been consequent upon the pressure of public agitation, according to the teaching of Lord Haldane, though we happen to know something of the extremely difficult nature of the problems that have arisen, rendering the exercise of careful discrimination most necessary. But the attacks, indiscriminate and otherwise, have also been due to the method of the German in secretly getting in here and there, and managing, by the aid of characteristic devices, to conceal his whereabouts. Even now there are difficulties in the way of those who have strong suspicions, amounting almost to convictions, regarding certain traders, but can neither confirm nor disprove them. The best thing in such a case is for them to lay the matter before the Board of Trade—they can do that without running any risk, and they will not put upon the Press a burden that it ought not to be required to carry. We learn from Australia that the Press out there, which has attacked many concerns about which it has been difficult to ascertain the true facts relating to their connections, ownership, and interests, has, after bearing the burden of risk involved, now been protected by a special War Precautions Act which was passed in June. This Act prohibits any person from taking action, without the written consent of the Attorney-General, against any other person, for relief, "in respect of anything said or done, or permitted to be said or done, by the defendant, which states or implies that the plaintiff is an enemy subject or a person of enemy origin or associations, or influenced or controlled by enemy subjects, or having, or intending to have, any connections with enemy subjects . . . . either personally or in his trade or business." It is provided that the Attorney-General shall not withhold his consent where he is satisfied that the statement or implication has been made maliciously or recklessly. With this provision included, it seems to us that the measure is a very desirable one under the prevailing conditions. In many respects during the war Australia has been far more advanced in its methods than the Mother Country. Here the Government leaves the Press to fight its own battles, and preserves privileges to the man of straw against the well-intentioned newspaper.

Pig Lead.

Although the situation in pig lead has remained under the close supervision of the Ministry of Munitions, the market has admittedly again felt the effect of the enormous requirements for munitions in one direction or another. Until a few weeks ago, the selling operations on the part of the authorities in connection with the surplus parcels which could be spared out of the controlled supply from Spanish and Australian sources tended to keep prices down. Subsequently market movements have been apparently chiefly determined by the preparations which were made by the Government to make adequate provision for Russian requirements over the winter months. This, coinciding with a temporary considerable contraction of the arrivals through delayed

shipments, no doubt has naturally enough left the market rather bare of near metal. Hence the tendency became sensitive, which with a more insistent demand from consumers in other directions has resulted in a steady advance in prices, more especially in near positions.

In the course of the past week, the market was particularly bare of sellers, so much so, in fact, that purchases were more difficult, and only a comparatively limited amount of business could be got through. The premium on spot delivery was forced up to quite £2 a ton, which is not surprising, for so far as can be gathered there is very little metal held in warehouse to meet urgent needs. The position still seems rather tight, and some further hardening of prices in near positions may ensue, but there is good reason for assuming that some relief is now pretty near at hand, judging by the fact that more liberal supplies have reached this side lately from Spain. For one thing, there is not much doubt that Russian needs have been satisfied for some considerable time to come, so that there should be more lead to spare to meet requirements in other directions. Considerable quantities went to Russia *via* Archangel and also Vladivostock, and it is not expected that much more will be diverted to the latter port. It is well to bear in mind that the market is absolutely under Government control, and since it is understood that the latter have now made pretty full provision for all their munition contracts for several months to come, it is suspected that a change of feeling may eventually ensue should controlled lead at any time come on the market in appreciable quantities. History is likely to repeat itself in that respect, for it is an open secret that the authorities will neglect no opportunity to prevent an undue inflation of values. The fact, however, that France continues to draw supplies from Spain on a large scale by rail tends to keep the Spanish exports to this side on a rather restricted scale.

Shipping conditions may possibly improve since the requisition of German ships released by the Portuguese Government, and this would facilitate the accession of fresh supplies, but under present conditions it is hardly likely that surplus supplies will accumulate to any very large extent. For some time past the American position has been tight, partly due to the considerable quantities shipped to Russia *via* Archangel, and New York prices have again risen, but this feature is not calculated to have any material influence on this market. A set-back in prices in America would cause no surprise, since the Russian demand has been met. The market here this week re-opened with a firm tone, sellers being still reserved pending developments.

The B.A. on the Tyne.

On Tuesday next the 86th annual meeting of the British Association for the Advancement of Science will be opened at Newcastle-upon-Tyne. As at the previous war meetings, there will be no excursions or festivities, and the sittings will be confined to four or five days, but we have no doubt that, as last year, good work will be done and results of national value will accrue. The Association has a long record of usefulness to its credit, and in its title, which we purposely quote at full length, may be discerned the aspirations of its far-sighted founders, who recognised the importance of propagating a due appreciation of the value of science in the public mind. We rejoice to think that the aims of those wise men are now approaching fruition, though nothing less than a war directly involving the destinies of at least 14 nations, and indirectly affecting the whole world, has been necessary to awaken the British people to the perilous condition to which the apathy and ignorance of their rulers had brought them.

Details of the programme have not yet been received, but we are glad to note that prominence will be given to such questions as "Education after the War," "Economics after the War," and "Fuel Economy and Smoke Prevention"—all subjects of first-class importance to the nation. Mr. Gerald Stoney will preside over the Engineering Section, in which a number of papers on matters of immediate interest are set down for reading by distinguished authors. The interim reports of the Fuel Economy Committee and the five Sub-Committees which were deputed to examine specific questions are expected to be of exceptional value and importance. There is good reason to anticipate, therefore, that the meeting will be noteworthy from a scientific point of view, and we wish it every success.

Science and Industry.

Yesterday the report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1915-16 was published, together with the vastly more loquacious report of the Advisory Council and its five Appendices. The latter commences with a review of the past 16 years purporting to show that the Government during that period had done much to encourage "organised scientific support for our trades and industries," but in view of the niggardly and absurdly inadequate grants to the National Physical Laboratory (still only £7,000 a year), and the meagre recognition and assistance afforded to the Engineering Standards Committee, the Imperial Institute, and the Imperial College of Science and Technology, the instances cited by the Council as evidences of the said "encouragement," we are unable to join even in the faint praise with which the Council damns the authors of its being.

Optical glass, dyestuffs, magnetos, drugs, and zinc are once more paraded as the chief items whose conspicuous scarcity compelled the Government to take action just two years ago, with the result that the first meeting of the Advisory Council was held one year ago, and the organisation of science in aid of industry was at last commenced.

The necessities of the case compelled the Council to give attention first of all to science in its immediate applications to industry rather than to the development of pure science, upon which those applications ultimately depend. The first proceeding of the Council was to rescue from abandonment certain researches which were being carried on by professional associations, by means of grants to the societies concerned, some of which have been recorded in our pages. Conferences were held with representatives of all the scientific and engineering societies in the Kingdom, and several trading associations, with gratifying results. A register of researches in progress at the outbreak of war was drawn up, and grants were made to some 40 individuals. Standing Committees have been appointed to deal with specific subjects, and other committees will be formed. A large part of the Report consists of a running commentary on the doings of other bodies interested in the maintenance of British trade supremacy, many of which have been recorded in our columns, and the practice of our American and German competitors is reviewed; we hope to deal with it more fully at an early opportunity. At the moment we can only give the terms in which the Council summarises the conditions that appear to be necessary for the success of its work; these are, in the briefest form: "First, a largely increased supply of competent researchers; secondly, a hearty spirit of co-operation among all concerned, men of science, men of business, working men, professional and scientific societies, universities and technical colleges, local authorities and Government departments. And neither condition will be effective without the other."

SWITCHBOARDS FOR POLYPHASE TESTING.

By A. T. BULLEN.

To the electrical engineer, the value of a switchboard is not its cost in pounds, shillings, and pence, but is rather the amount of work and number of operations it is capable of performing. Yet, on account of the expenditure involved, switchboards are more often than not designed for one specific purpose and for but one distinct set of operations.

The cost of erecting and throughly equipping a testing switchboard for polyphase currents is, as a rule, much more than the central-station engineer is prepared to spend, and so we often find that the testing of two or three-phase meters, for instance, is sadly neglected, or is, on the other hand, carried out by the use of single-phase current, which, while giving approximate results, does not cover all the possibilities of a three-phase circuit.

One of the greatest obstacles in the way of three-phase testing is the cost of the necessary instruments. The writer, therefore, proposes to illustrate and explain a simple arrangement of switches adopted in one of our municipal testing departments, whereby the current in any phase of a three-phase system can be measured on a single instrument without stopping to change the connections.

The arrangement is shown in diagram 1.

A, B, C, and N are single-pole switches inserted in the three phases and neutral of a star system.

P, Q, and R are double-pole, two-way switches. The centre contacts of Q are taken to the current terminals, where an ammeter or the current coil of a wattmeter is inserted.

The two top contacts of switch Q are connected to the centre contacts of switch P, and similarly the bottom contacts of Q are connected to the centre of R.

The top and bottom contacts of P and of R are then connected across the switches A, B, C, and N respectively.

By opening the switches A, B, C, and N in turn and altering the two-way switches accordingly, it is obvious that without disturbing the circuit we can measure the current in any phase or the neutral.

This arrangement is particularly suitable for balanced loads, and is used almost exclusively for motor testing.

A somewhat similar arrangement might be used for the pressure, but it is the opinion of the writer that the simplest possible method for pressure is the use of wall-sockets. An arrangement as shown in diagram 3 covers all possible connections.

The phases are brought in according to the letters on the plugs.

The above is a very useful, although a very simple, board; and, moreover, it is not costly.

It is, however, limited in its scope, and is hardly suitable for unbalanced circuits. To meet these requirements, therefore, a more elaborately designed board is in use.

The equipment consists of three single-phase transformers, each of 6 K.V.A. output, the primaries and secondaries of which are both wound in two equal sections, which can be joined in either series or parallel. The ratio of transformation is 6 to 1, the primary volts being 415. Each transformer connected singly is, therefore, capable of giving secondary voltages, as under :—

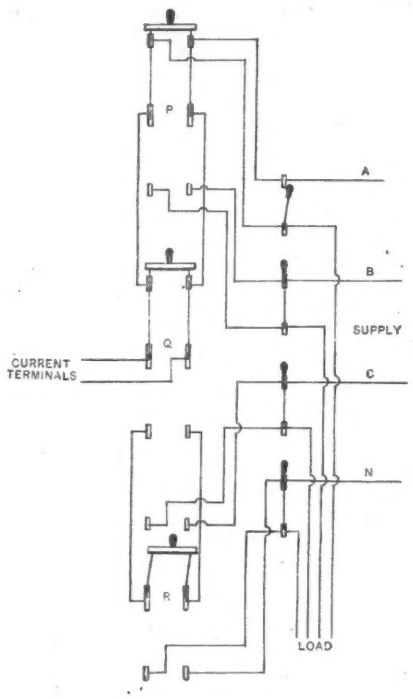

Diagram 1.

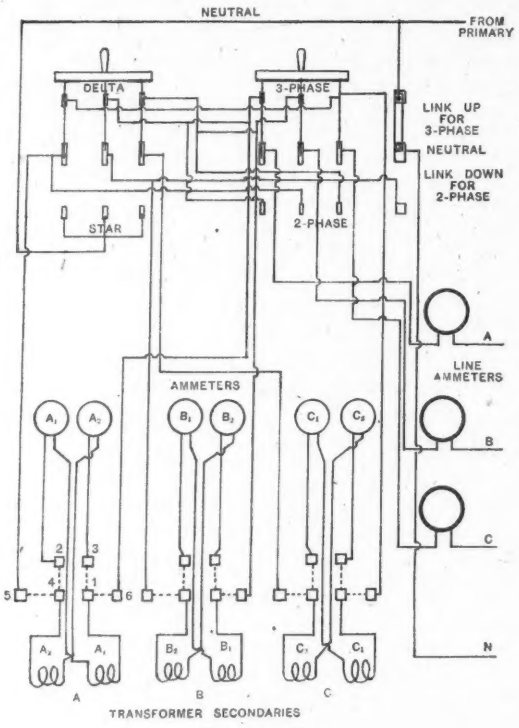

Diagram 2.

Primary volts.	Primary connections.	Secondary connections.	Secondary volts.
415	Parallel	Series	138
,,	,,	Parallel	69
,,	Series	Series	69
,,	,,	Parallel	34·5

When the transformers are connected to form a three-phase system, there is a much greater range of secondary voltages.

Below is a tabulated list of the connections and secondary voltages, for both star and delta combinations :—

THREE-PHASE.

Primary volts.	Primary connections.	Secondary connections.	Secondary volts.
415	Parallel-Δ	Series-Y	239
,,	,,	Parallel-Y	119·5
,,	,,	Series-Δ	138
,,	,,	Parallel-Δ	69
415	Parallel-Y	Series-Y	138
,,	,,	Parallel-Y	69
,,	,,	Series-Δ	80
,,	,,	Parallel-Δ	40
415	Series-Δ	Series-Y	119·5
,,	,,	Parallel-Y	60
,,	,,	Series-Δ	69
,,	,,	Parallel-Δ	34·5
415	Series-Y	Series Y	69
,,	,,	Parallel-Y	34·5
,,	,,	Series-Δ	40
,,	,,	Parallel-Δ	20

In addition to this each transformer is provided with tappings to allow for Scott connections for transforming to two-phase. In this case, of course, only two transformers are used, the secondary voltages obtainable being as under:—

TWO-PHASE.

Primary volts.	Primary connections.	Secondary connections.	Secondary volts.
415	Parallel	Series	138
"	"	Parallel	69
"	Series	Series	69
"	"	Parallel	34·5

The switchboard is designed to give all the above arrangements with a minimum of trouble.

Diagram 2 shows the arrangement on the secondary side of the transformers. The primary connections are similar, but with an additional panel for Scott connections.

The half-windings of the secondaries are brought to contacts, on the lower panel of the board, numbered 1 and 2

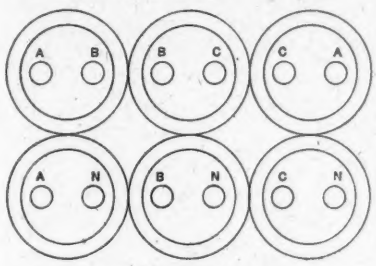

DIAGRAM 3.

for one coil, and 3 and 4 for the other. It is clear that by linking numbers 2 and 3, the coils are connected in series, and that by linking 2 and 4 and 1 and 3 they are joined in parallel. Ammeters A_1, A_2, &c., are placed in circuit in each half winding, which can be reversed or entirely cut out by means of contacts 5 and 6.

Two three-pole two-way switches on the top panel control the connections, and are wired to give three-phase Δ with the left-hand switch up, and three-phase Y when down.

The right-hand switch is thrown up for three-phase, and down for two-phase, when, of course, the left-hand switch is out of use.

The neutral is brought through from the primary board on to a special link, which also has to be changed over for two-phase working, since the neutral then forms the fourth wire of the two-phase system. Ammeters are placed in the three lines A, B and C.

The maximum secondary line current, without over-loading, is 150 amperes on the three-phase and 90 amperes on the two-phase.

It is obvious that when the primaries are connected in series, only half the output is available.

The pressure arrangements are dealt with as before, being brought to six wall-sockets, as in diagram 3.

At present no phase-shifting device is installed, but there is a plentiful supply of inductances, which, so far, has met all requirements.

The chief merits of the board are its adaptability, and, at the same time, its simplicity of operation. In construction it is not elaborate, but it will do all that is required for ordinary purposes, and a good deal more than many a more costly board.

Electricity on Aeroplanes.—From the annual report just issued by the Advisory Committee on Aeronautics, we learn that during the past year two wireless telegraph sets of very light weight have been designed and tested at the Royal Aircraft Factory. A number of special tests have also been carried out in connection with the ignition magnetos of aeroplane engines, and an improvement has been effected in the system of electric lighting of aeroplane instruments.

B.T.H. TURBO AIR COMPRESSORS.

THE turbo-compressor, which is to-day constructed in single units of the largest output, has been developed within a period of about ten years.

Compressors of this type have been built in sizes ranging up to 60,000 cu. ft. per min. of free air, up to a pressure of 170 lb. per sq. in. gauge when running at a speed of 3,000 R.P.M. This output corresponds to an input of 12,000 to 13,000 H.P. measured at the shaft.

The outstanding advantages of turbo-compressors as compared with reciprocating compressors may be summarised as follows:—

(*a*) The floor space occupied is much smaller, the capital expenditure is less, and the over-all efficiency is higher.

(*b*) Much lighter foundations are required, and the turbine drive permits of the condenser being placed immediately below the turbine, with a consequent reduction in the length of the eduction pipe.

(*c*) No internal lubrication of the compressor is necessary, and since with turbine drive forced lubrication is provided to all bearings, a considerable amount of oil is thus saved and less attention is required.

(*d*) The turbo-compressor permits of the use of exhaust steam from winding, hauling, rolling-mill engines, &c.

(*e*) The supply of air from a turbo-compressor is free from oil, which is a *sine qua non* in the case of certain chemical processes.

(*f*) The air delivered by a turbo-compressor is continuous in supply, and not pulsating, as in the case of reciprocating machines.

In designing turbo-compressors, the British Thomson-Houston Co., Ltd., have kept before them the vital importance of producing a machine which will be reliable in operation and of high efficiency.

The multistage construction employed permits of the advantages of cooling, and it is possible to approach the isothermal pressure curve more closely than in a piston compressor with staged compression and intermediate cooling; the air, which is inhaled through a suitable duct, passes through

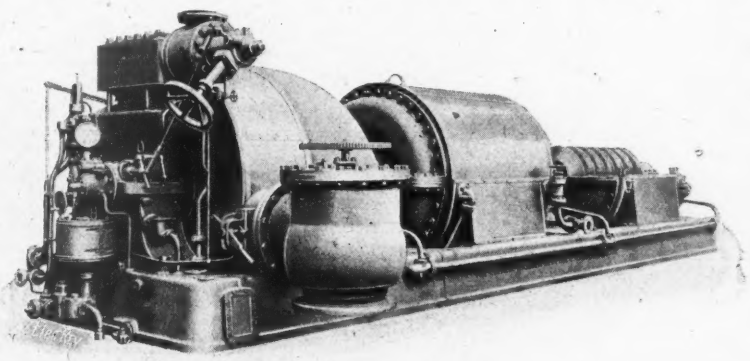

FIG. 1.—B.T.H. TURBO AIR COMPRESSOR, STEAM END.

a number of stages in series, the stages being divided over two casings, since the number of impellers is too large to be carried on one shaft. The work done in compressing the air in each set of stages is approximately of equal value.

Each casing contains a number of diaphragms, the space between the diaphragms forming the stages; the ends of the casings are provided with covers which have the inlet and outlet ducts cast in them. The impellers are mounted on shafts which revolve in bearings of patented design, which permit of high speeds of rotation without appreciable vibration. The impellers are constructed of high tensile strength steel of the best quality,

accurately turned and bored, and are forced on to the shafts by hydraulic pressure, the fit between the impeller and shaft being provided by means of special bronze rings embedded in the bore of the impeller, according to the patented practice of the British Thomson-Houston Co., Ltd. Thanks to this construction, which is standard both for turbo-compressors and turbines, loose fits, with consequent vibration, are unknown.

The vanes of the impellers are attached to the impeller disks in such a manner that trouble due to loose vanes is an impossibility; this defect has been known to occur in the case of impellers of the usual riveted type, with the result that serious vibration troubles have been incurred.

The shroud plates of the impellers are machined from pressings of extra high tensile strength steel plate.

The flow of air through the two sets of impellers is so arranged that the end thrust of one set of impellers is eliminated by that of the other set of impellers, the two shafts butting together between the bearings to be found in the centre pedestal situated between the two casings.

The connection between the two shafts for driving purposes is through a flexible coupling of the claw type, and the coupling between the turbine and the compressor is also of the same type.

The position of the two sets of impellers relative to the casing is determined by a multi-collared thrust bearing situated in the outboard pedestal of the compressor. The value of the load carried by the collars of this thrust bearing is very slight, due to the excellent balancing of end thrust between the two sets of impellers.

The two casings are connected together by means of piping, and if a comparatively low temperature of air at the delivery of the compressor is required, an inter-cooler may be connected in at this point in place of the pipe mentioned above. By this means the temperature of the air can be reduced to approximately 136 deg. F. with an inlet cooling water temperature of 50 deg. F., the final air pressure in this case being 120 lb. per sq. in. gauge.

After the air has passed through an impeller, it passes through a set of guide vanes in the diffusers, by means of which a high efficiency is obtained, and by the suitable design of these vanes a very silent operation of the compressor has been secured.

The cooling of the air as it passes through the casing is very effective. Cooling is necessary, of course, in order to reduce the power required to compress the air, and also to reduce the final temperature of the air, which would otherwise be excessive.

The water jackets surround the impeller chambers, the diffusers, and the return passages, whilst the hollow partitions separating the return passages from the diffusers are also supplied with circulating water. All the water connections are external.

Cooling blades of cast-iron are attached to the hollow partitions between the stages for the purpose of increasing the cooling surface. These blades, furthermore, ensure correct flowing of the air in the direction of the following impeller.

Due to the method of construction employed, the surfaces over which the air will pass can be easily ground and machined to a smooth finish and by this means the friction losses are greatly reduced, with a consequent increase in the efficiency of compression.

The sealing of the openings in the diaphragms, through which the shaft passes from stage to stage, and also in the covers of the casings is effected by a patented construction consisting of an internally-grooved ring split into four parts, and held together by leaf openings. The ring fits in a groove turned in the diaphragm, which prevents it moving inwards on to the shaft, but at the same time allows it free movement outwards. This effectually guards against any possible risk of damage due to inaccurate assembly, and enables fine shaft clearances to be used without danger. The shrouding of the impellers at the inlet annulus is also provided with similar packings to reduce the short-circuit losses.

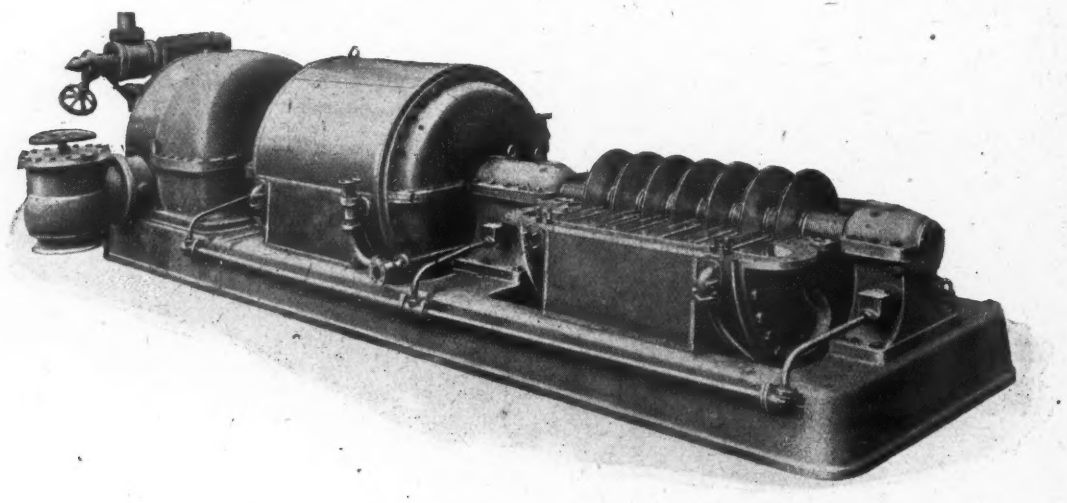

Fig. 2.—B.T.H. Turbo-compressor, with Casing Removed.

In order to maintain a constant pressure of air at the delivery of the compressor, independent of the quantity of air being used, the speed of revolution of the turbine and compressor is varied. This effect is produced by means of a piston moving in a cylinder, which is acted upon by the delivery air pressure from the turbo-compressor. The piston operates the pilot valve, which controls the supply of steam to the turbine.

In actual operation it is found that this type of governor will maintain the pressure at the delivery of this compressor constant to within 2.0 to 3.0 lb. per sq. in., with a variation in output on the delivery mains from practically full load to no-load and *vice versa*.

The compressor illustrated herewith is driven by a mixed-pressure turbine of the Curtis type. The details of construction of the Curtis type of turbine are now so well known that they need not be recapitulated.

The turbine in the case of the machine illustrated is in operation at a well-known colliery in the Midlands, and receives its supply of exhaust steam from winding, hauling, and other engines at the pit brow.

The capacity of the machine is 5,000 cu. ft. of

free air per minute up to a pressure of 80 lb. per sq. in. gauge. It has also an overload capacity of 6,250 cu. ft. of free air per minute at the same delivery pressure.

The normal speed of rotation is 4,600 R.P.M. at full load.

The machine is not provided with an inter-cooler, as a low temperature of air at delivery was not specified.

The compressed air in the case of this machine is employed in coal-cutting, operating haulages, ventilating, &c. Although the demand for compressed air in the case of this machine varies very considerably, and ranges at times from 5,000 cu. ft. per minute down to 1,500 to 2,000 cu. ft. per minute in less than 30 seconds, the variation in pressure of the air at the delivery of the compressor does not exceed 2.0 lb. per sq. in.

THE JOHANNESBURG MUNICIPAL ELECTRIC POWER STATION.

(*Abstract of paper read before the* SOUTH AFRICAN INSTITUTION OF ENGINEERS, *by* J. H. DOBSON. M.Sc., M.Eng.)

(*Continued from page* 223.)

THE PRESENT STEAM PLANT.*

Coaling Arrangements.—The Council has a branch railway siding which runs from Braamfontein station to within the power station yard. When the coal trucks are shunted into the yard, the coal delivered is weighed on an Avery triple combined weigh-bridge which has been erected some 200 ft. from the boiler house. Between the weigh-bridge and the boiler house is an underground coal boot into which the coal is delivered. The coal trucks are generally fitted with bottom hoppers, which when opened allow the coal to fall into the coal boot without any handling. The boot has a capacity of 300 tons. There are four discharge doors in the bottom of the coal boot, through which the coal falls on to a tray conveyor, 50 ft. long. The coal falls from the tray conveyor into a rotary automatic filler, which in turn feeds the coal into a gravity bucket conveyor. The coal is then elevated from the shaft at the end of the coal boot to the coal bunkers, which have a capacity of 400 tons and run the whole length of the boiler house.

The gravity bucket conveyor is capable of dealing with 40 tons of coal per hour; the total length of the conveyor, including the return, is 580 ft.

The kind of coal used at the power station is chiefly nuts from the Middelburg district. Investigations were carried out as to the economic value of nuts, peas, and duff; unless peas and duff coal are purchased at an appreciably lower price than nut coal, the latter is far more economical. As the price of duff peas landed at the power station is only between 1s. and 2s. a ton less on a price of about 10s. per ton, nut coal is almost entirely used. The coal is purchased in accordance with a specification based chiefly upon calorific value.

For removing the ashes a shaft was first put down at the south end of the boiler house, and a tunnel was driven underneath the centre line, the distance from floor level to the bottom of the tunnel being 27 ft. This tunnel extends the whole length of the boiler house.

The ash gullies or chutes connecting the back of the chain grate stokers were then driven upwards and connected to the tunnel, which is lined with hard blue bricks.

All the above work was carried out departmentally, without interfering with the working of the boiler house.

The ashes fall directly into the ash gullies through mouthpieces. In the tunnel pans are filled with ashes by opening the chute doors; they are then run along rails at the end of the tunnel, and are elevated to the receiving bin by means of a tray conveyor. At present the ashes are removed from the bin by mule wagons, although arrangements have been made, when a suitable dumping site has been obtained, to remove them by electric freight cars capable of holding eight tons of ashes.

A large amount of patience and foresight were involved in the process of installing chain-grate stokers, superheaters, and economisers in those boilers which were originally installed without these accessories.

Three chimneys were removed to provide the boilers on the east side of the boiler house with economisers and proper draught arrangements. Before the chimney stacks could be removed the new draught arrangements had to be erected ready for connecting to the boilers. There is now only one natural-draught chimney, which is connected to Nos. 6, 7, and 8 boilers, which are not fitted with economisers.

There were installed six sets of indirect induced-draught plants on the Schwabach system, which is similar to the well-known Prat system. The discharge air ducts of the fans are carried inside the chimneys and fitted with nozzles, the opening of the nozzles being varied by means of specially formed regulating bodies, which are operated by hand winches placed conveniently near the boilers. An emergency steam jet is fitted into each chimney. This provides an effective stand-by in case of trouble with a fan or motor, and, again, the jet may be used in conjunction with the fan should it ever be necessary to force the boilers due to a very sudden increase of steam demand, or if any of the other boilers are thrown out of action.

Each draught plant deals with two boilers, and operates satisfactorily with all the coal required for evaporating 34,000 lb. of water per hour. The fans are driven by direct-coupled motors of 50 H.P., running at a speed of 1,080 R.P.M. on 460 volt direct current. The temperature of the gases entering the economisers is about 520 deg. F., and when entering the chimney is about 308 deg. F. The draught at the end of the boilers is about .375 in., at the foot of the chimney ⅝ in. natural draught, and 1 in. when the fan is working.

After an experience of five years it may be stated that these draught plants have given general satisfaction.

The question of installing mechanical stokers had to receive early consideration. The final choice was between the Erith underfeed stokers and Babcock & Wilcox chain-grate stokers. The underfeed stokers were cheaper by several thousands of pounds, and the principle of their action is generally admitted to be perfect, in that combustion takes place within the burning fuel itself without any necessity for specially built arches as required by the chain-grate stokers. Before the final choice of stokers was made the Johannesburg representatives of the underfeed stokers, at their own expense, fitted up a Babcock & Wilcox boiler with their stokers, and their working was compared with that of a chain-grate stoker on a similar boiler. The underfeed stokers certainly showed great flexibility, and combustion could be obtained as nearly as possible perfect. Taken over a period of six hours' running, the tests for lb. of water evaporated per lb. of coal were always favourable to the chain-grate stokers, but the chief point which made the adoption of the underfeed stokers absolutely impossible was the necessity to open the furnace doors at regular intervals for cleaning purposes, as the ashes cannot be disposed of as in the case of chain-grate stokers, and, in addition, there was the tremendous clinkering of the Transvaal coals. Accordingly, chain-grate stokers with the necessary brick arches were installed one by one in all the boilers.

Five "Auto" CO_2 recorders are connected to the various groups of boilers. With boilers working under normal conditions, with a draught at back of boiler of .375 in., the average percentage of CO_2 is 10 to 12.

The Bettington boiler is of relatively new design; the chief pioneering and experimental work was carried out on the Witwatersrand by the late Lieut. Claude Bettington and Mr. Robeson, formerly consulting mechanical engineer of the Central Mining & Investment Corporation. Facilities were given to the manufacturers (Messrs. Fraser & Chalmers) to install one of these boilers, which was in the experimental stage—to be paid for provided the boiler gave satisfaction. The particulars of this boiler are as follows:—

Evaporative capacity, per hour	34,000 lb.
Heating surface, 240 tubes, 3¼ in. dia., 22 ft. long	4,480 sq. ft.
Heating surface of boiler shell	460 sq. ft.
Heating surface of superheater tubes	1,200 sq. ft.
Heating surface, 75 economiser tubes, 3¼ in. dia., 22 ft. long	1,400 sq. ft.
Heating surface, 188 air-heater tubes, 3¼ in. dia., 10 ft. 10 in. long	1,730 sq. ft.

As the above boiler is the largest of its kind that has been made, some particulars will probably be of interest.

Fig. 3 shows the arrangement of the boiler. It consists briefly of solid drawn steel vertical tubes connected at the top and bottom to mild steel annular headers. The top header is fitted with doors for drawing out the tubes whenever necessary. The steam drum is fitted into the annular space of the top header, large holes being made in the periphery of the steam drum to form one common water and steam space at the top of the boiler. The top and bottom headers, together with the vertical tubes, form a circular structure like a huge cage. The interior part of this structure forms the combustion chamber, where the fuel is burned. The coal is placed in the coal bunker, fed into the coal hopper, and falls by gravity on to a worm gear, which forces the coal into a combined pulveriser and blower. This latter arrangement is simply an ordinary centrifugal fan with heavy blade or beater tips, and with a constricted space between the ends of the beaters and the casing. The boiler under review is fitted with two sets of combination blower-pulverisers, each directly driven by 100-H.P. motors at approximately 1,400 R.P.M. Each pulveriser is capable of giving the full rated output of the boiler. In this way the coal is driven outwards by centrifugal force, and is crushed to fine dust and blown into the dust chamber. The heavy particles fall back again into the pulveriser to be further crushed to fine dust. This is carried upwards to the air and fuel pipe, which terminates in a large

D

* A full illustrated description of the present power station appeared in the ELECTRICAL REVIEW of January 21st—February 11th, 1916. The following are supplementary details taken from Prof. Dobson's paper.

tuyere, and the coal dust when ignited burns like a large Bunsen burner. The ignited coal dust forms a mushroom-shaped flame within the closed ring of vertical tubes which form part of the steam producing plant. The flame strikes the bottom of the steam drum, is deflected downwards, and passes over the interior row of tubes, which are protected from the high temperature of the combustion chamber by specially shaped firebricks. The hot gases are then deflected upwards and pass over the outer rows of vertical water tubes and the superheater tubes, and finally round the economiser tubes through which the boiler feed passes before it gets to the boiler. There is also another set of tubes through which the gases pass before entering the chimney and passing to the atmosphere. This latter set of tubes forms a separate air heater, and is connected to the pulveriser blower, which draws the air around the hot tubes, thus heating the air before it passes into the boiler and enabling the pulveriser to deal with fairly wet coal. The superheater tubes are connected to the upper part of the steam space of the top header by means of a steel expansion pipe, and the superheated steam is led away to the mains in the usual way. The firing of the boiler when cold is done at the municipal station by inserting a 2-in. gas pipe into a 4-in. air pipe to form a large Bunsen burner, the whole being placed inside the tuyere, and the boiler is started up instantly by simply lighting up the large gas jet.

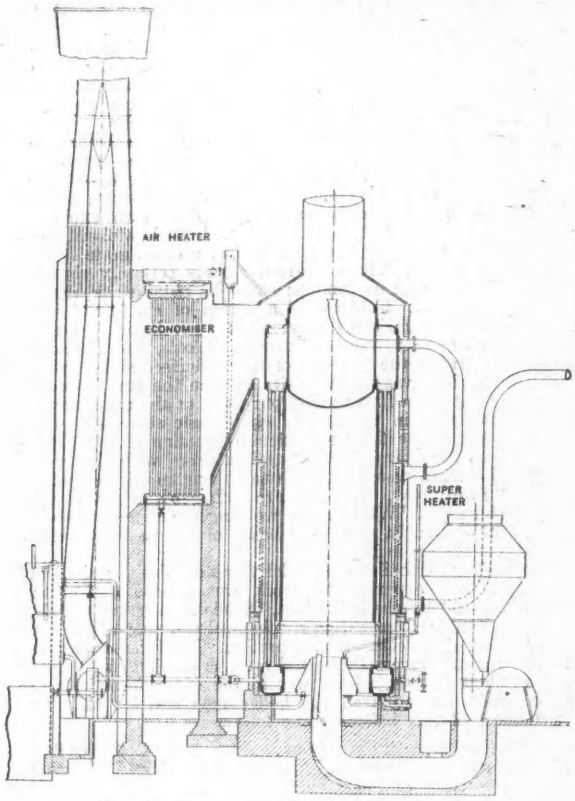

Fig. 3.—Bettington Boiler Arrangement.

The Bettington boiler was installed in 1911, and a thermal efficiency of 85 per cent. was guaranteed. The boiler, as depicted in the figure, had to be somewhat modified. At first it was fitted with a parallel chimney 60 ft. high and 4 ft. 6 in. diameter. It was expected that the pulveriser, which acts as a fan and produces a pressure of 1 in. to 1½ in. in the combustion chamber, would be sufficient to force the hot gases around the boiler tubes, the economiser and air heater tubes, and thence up the chimney. In practice, however, the gases were somewhat choked, and cooled to such an extent that additional draught had to be provided to get the full capacity out of the boiler. It was impossible to modify the air pressure at the pulveriser, as it interfered with the combustion of the coal dust. The economiser and air heater were considerably reduced, and a more direct path for the gases to the chimney was provided, by raising the air heater about 26 ft. In addition, the boiler was fitted with a Schwabach indirect induced-draught plant exactly similar to those installed on the other boilers, and the height of the chimney in the new arrangement is 86 ft., the draught at the bottom of which is about ½ in. In this way the rated capacity of the boiler was obtained, but its efficiency was somewhat lowered. No doubt in the future design of this boiler its efficiency can be somewhat improved by a proper relation between the pulveriser pressure, the boiler tubes, and the magnitude and arrangement of the economiser and air heater system without the necessity of an additional mechanical draught system at the base of the chimney.

After these alterations and certain adjustments at the pulverisers were made, the boiler, whilst not attaining the high efficiency of 85 per cent. as guaranteed, was considered thoroughly reliable for the purposes for which it is used at the municipal power station. Practice shows that the water tubes are practically self-cleaning. The inner row of water tubes does not appear to show any unusual evil effects by being close to the combustion chamber. During a period of four years very few tubes have been replaced. The boiler can be, and is, usually put on the steam mains from cold in about 20 minutes to half an hour from lighting it up by gas. The boiler is usually run to take the evening peak load, but has been run regularly day and night on occasions for a period of over a week, during which time it is necessary to rake out the pebbles of slag every 12 hours, and there was no particular trouble experienced through slag depositing on the brick lining. This boiler has been of great service when part of the other boiler plant has been suddenly put out of action. Its ability to get up steam quickly is regularly taken advantage of, especially during the rainy season, when sudden large increases of load arise in a very short time. As it is fitted with two pulverisers, each of which can give the full rated output, its overload capacity has oft-times proved exceptionally useful. Needless to say, the boiler was paid for and taken over, and it forms a valuable portion of the boiler plant, working on conditions of large and sudden power demands.

The last boiler installed is one of the Babcock & Wilcox patent marine type water tube boilers, having 5,780 sq. ft. of heating surface, with an evaporation of 35,000 lb. per hour from and at 212 deg. F. with coal common to the Transvaal. This boiler is fitted with two chain-grate stokers, a patent superheater, and an economiser. The boiler is connected to a mild steel chimney arranged with the Prat system of induced draught.

The following shows the results of some comparative tests that have been carried out on this boiler and the modified Robeson-Bettington boiler:—

	Bettington tests.	Babcock and Wilcox tests.
Gauge pressure, lb. per sq. in.	173·7	161·9
Feed temperature	65·5° F.	64·7° F.
Steam temperature	510·3° F.	546° F.
Water evaporated per hour	31,561 lb.	29,370 lb.
Lb. of water evaporated per lb. coal (as fired)	7·050 lb.	7·014 lb.
Net calorific value of coal as received	11·10	11·42
Evaporated equivalent from and at 212° F. (as fired)	9·049	9·140
Evaporative equivalent from and at 212° F. (dry)	9·464	9·868
Percentage auxiliary power	3·8	1·0
Efficiency on net calorific value ...	81·4	80·0
Net efficiency on net calorific value ...	78·3	79·1

The make-up water is obtained from two sources:—

(*a*) Five boreholes, sunk to depths of about 300 ft. in different parts of the works ground, the supply from which during recent years has steadily declined; and

(*b*) Town supply mains.

Owing to the amount of chlorine which has developed in the borehole water during recent years, it is now almost exclusively used for the make-up for the cooling towers, and town water is treated for the boiler feed make-up.

An approximate analysis of the town water shows:—

Alkalinity	3.68 deg.
Total hardness	29.6 deg.
Permanent hardness	11.4 deg.

The water has been treated for several years by a fluid called "Noxal," which has a very alkaline reaction, and contains about 8.48 grammes of soda in 100 c.c. of the fluid. The town make-up water is about 25,000 gallons per day. Four gallons of Noxal fluid is diluted with about 20 gallons of water, this amount being used every day. The mixture is placed in a cask over the feed tank and allowed to trickle into it continuously. In this way the scaling of boiler tubes and their renewal is kept within reasonable limits, the Noxal having the effect of loosening any scale which may be formed. It is removed from the boiler by the blowing-down arrangement, and takes about 50 gallons of water per boiler per 24 hours.

The condensed water from the three turbines is pumped direct into the feed tank without treatment, as it is practically free from oil.

The condensed water from the reciprocating engines is treated in a Davis-Perrett de-oiling plant, after which it flows into the main feed tank. The amount of water that can be dealt with is 3,000 to 4,000 gallons per hour.

The following are results of analyses showing the amount of oil in the water before and after the above treatment:—

Amount of oil found before entering de-oiler ...	.012 p.c.
Amount of oil after electrical treatment ...	.003 p.c.
Amount of oil after filtering	.0004 p.c.

This method of removing oil from water has been most effective, but good results were only obtained after considerable trial and failure. The analysis of the water in the feed tank shows:—

Alkalinity	1.44 deg.
Total hardness	12.0 deg.
Permanent hardness	4.8 deg.

There is the objection to the use of the "Noxal" boiler fluid that its work is done inside the boiler itself, but investigations went to show that this fluid does not act injuriously upon the boiler tubes and plates. The results obtained have been very satisfactory, so far as the replacement and cleaning of boiler tubes are concerned. To further improve the water feed it has been decided to install a Lassen & Hjort water purifying plant.

The electric supply from the Johannesburg power station is led to three distinct sections of the distribution plant: 3,300 volts A.C. for the suburbs, 600 volts D.C. for traction, and 460 volts 3-wire D.C. for the inner area of Johannesburg. In any case it was necessary to install direct-current generating plant. The author came to the conclusion that it was too risky to embark on direct-current turbo-generators, because of the inevitable difficulties connected with commutation, more especially having regard to the exceptional dust experienced in Johannesburg. The circumstances of space, however, and the future demand at the power station, put all plant out of consideration other than turbines, and the scheme ultimately decided upon was that of turbo-alternator generating plant, the direct-current requirements to be obtained by means of converters to transform the alternating to direct current. The scheme appeared to suit the distribution plant from the point of view of future growth of traction and power demand, as it became more and more obvious that the direct-current power supplied from the central station would diminish, whilst the alternating-current requirements would increase. There was also the point that with turbo-alternators and converters it would be possible to obtain all three requirements at times of low load from one steam turbo-alternator unit, this tending to economical running.

The plant installed has been impulse turbines, manufactured by Belliss & Morcom, of Birmingham. The first 3,000-KW. turbo-alternator was installed and put on load on October 5th, 1910, the second on July 7th, 1911, and the third on August 3rd, 1913. Orders for two additional 3,000-KW. sets have just been placed with Messrs. Parsons & Co., for plain reaction turbines running at 3,000 R.P.M.

The power plant installed in the engine room at the present date consists of two 500-KW. and three 1,000-KW. triple-expansion Belliss & Morcom engines, three 250-KW. Allen reciprocating sets, three 3,000-KW. turbo-alternators, all with Belliss & Morcom turbines, two 750-KW., and two 1,250-KW. motor converters of the La Cour type, manufactured by Bruce Peebles & Co.

The absence of large natural ponds and the scarcity of water on the Witwatersrand make the subject of cooling circulating water for turbines one of the greatest importance for the economical production of electric power. Whilst the temperature of the air and the high altitude militate against good cooling, there is no doubt that the low relative humidity of the air and the mean wind velocity of the Rand are factors which tend to good cooling. Numerous investigations were made before a final decision on the cooling arrangements was arrived at. The final choice was to erect "wind cooling towers" for each of the 3,000-KW. turbines. They were designed and made departmentally, and may be described as partially open, natural-draught cooling towers.

The salient features provide for good distribution of the water over the whole section of the tower and the complete breaking-up of the water before falling on the extended surface provided by brushwood, as well as the provision of a clear space at the bottom of the tower enabling the wind to get into the tower and to rise through the brushwood by the natural draught provided by the height of the tower.

The water falls through porcelain tubes (6 in. long by ¾ in. diameter, ordinary leading-in tubes used in the distribution branch of the department), which always keep themselves clean. The water emanating from the porcelain tubes is then broken up very effectively by zinc disks placed about 9 in. below the porcelain tubes, and the water thus broken up falls over the brushwood. Experiments were carried out, and it was found that so long as the ray of water impinges on a relatively smooth surface of any shape, it is effectively split up.

A feature of the circulating water piping to the condensing plant of the three turbo-alternators is that instead of the usual iron, it is made of Californian redwood. The pipes are of varying lengths up to 20 ft., the main pipe lines having an internal diameter of 20 in. They are composed of staves 3½ in. wide and 1½ in. thick, the edges having "V" tongues and grooves, the whole being bound together with 3/16-in. diameter steel wire, machine-wound tightly round the outside with a pitch between coils of 1 in.; the wire is further secured at intervals by staples. Before being wire-wound the pipes are accurately turned in the lathe to the proper dimensions both inside and out. The couplings consist of collars of a width of 12 in., built of staves and wired in exactly the same manner as the pipes. The ends of the pipes are slightly tapered for 6 in. back (where the wiring ends), and the joint is made by forcing the tapered portion into the collar after painting with red lead paint. Where bends occur in the pipe line, castings are used with tapered ends similar to those on the pipes, the joints being made in exactly the same manner as on the pipes themselves. They are much cheaper than cast-iron pipes and easy to run. In fact, owing to the presence of the gas plant and the enormous amount of underground piping, it would have been almost impossible to run iron pipes because of the gradual rise and fall in various portions of the ground to avoid cutting through existing pipes. The pipes take up by swelling after two or three days' working, and leakage entirely ceases. After several years' experience of this type of piping, it is regarded as highly satisfactory.

Owing to the barometer standing at approximately 24.75 in as compared with 30 in. at sea level, and the relatively high engine-room temperatures experienced in this country, for the same output and the same temperature rise, it is a wise policy to have electrical machinery about 30 per cent. bigger on the Rand than at sea level and in the home country. When working at full load and .8 P.F. in an engine-room temperature of about 100 deg. F. the alternators are sufficiently large to keep the temperature rise between 65 deg. and 70 deg. F.

When all the power required for auxiliaries is taken into account, the steam consumption per unit on full load is from 15.6 to 15.8 lb. at a back pressure of approximately 1.1 lb. per sq. in., and from an analysis of the various losses in the steam turbine the blade efficiency is from 88 to 90 per cent.

The first turbine has been running for nearly five years, and its running has been perfect. Some six months ago, after four years' continuous running, the low-pressure blading showed signs of pitting, and it was decided to replace it, but before carrying out this decision some of the blading stripped and the work had to be done more quickly than anticipated. It can be safely stated that the turbine ran for a period of four years before it became necessary to replace any blades, and all but the low-pressure blading have not been touched and are still satisfactory. Experience has proved that it is best to replace blades when they show pitting rather than wait for their final destruction. The second turbine has been running since July, 1911. Before this machine was finally taken over from the contractors, four rows of the high-pressure blading stripped and did some damage to the drum of the rotor. The Council had to acknowledge lack of foresight and inaction on the part of the driver in attendance on the turbine, and it was decided that the Council and the contractors should each pay half towards the cost of the breakdown. Apart from this the machine has run excellently since its installation four years ago, but, taking the experience on the first turbine into account, the blades at the low pressure end were recently replaced. The third turbine was installed in August, 1913, and has run satisfactorily to date. Taken altogether, the running of the turbines has been satisfactory, and the Council up to the present has been spared the calamities that have befallen some of the turbine plants that have been installed on the Witwatersrand.

The alternators have been remarkably free from electrical faults; in fact, there has not been a single fault during the whole time the three sets of turbo-alternators have been running.

The duty of the converting plant is to transform the two-phase alternating current generated at 3,300 volts, 50 cycles, to three-wire direct current for light and power at 460/520 volts, and direct current with compounding arrangements for traction at 500/600 volts. Two 750-KW. and two 1,250-KW. units were installed.

Motor converters were chosen on account of their established reputation as being reliable machines and obcupying a mean position with regard to capital expenditure and efficiencies of the motor generator and rotary converter. Only on two special occasions have the machines been used for the transformation of D.C. to A.C., but worked satisfactorily.

Speed limit devices were called for in the specification in case the machines came out of synchronism and attempted to run up to the full speed of the rotating field of the stator. In practice these have been found unnecessary, as the large current taken on the A.C. side under such circumstances brings out the circuit breaker.

The motor-converters have now been running for about four years. In general it has been found that motor-converters require much more minute adjustment than ordinary D.C. generators, but when once correctly adjusted the attention required is no greater than on any other type of D.C. plant. The doctor's bill has been relatively small. There have been two faults during the whole of their running, covering four years.

The guaranteed efficiencies were exceeded by about 1 per cent. The sizes of the converters are such that it is never necessary to work any of them below half-load, and the efficiency of transformation is thus never below 90 per cent. The power factor varies from .7 to .85 lagging when the converters are on lighting, and from .98 leading to unity power factor when on traction.

The perfect provision for balancing in connection with the motor-converters is a feature of the arrangement. Each of the motor converters installed in the municipal power station is capable of dealing with an out-of-balance current of 15 per cent. with a difference of voltage between the two sides of the machine of 1.5 per cent. of the average voltage per side, the middle wire of the three-wire system being connected to the middle or star point of the rotor windings through a terminal on the starting resistance, which is connected to the short-circuited slip rings.

The use of rotary balancers has been discarded; normally the out-of-balance load can be kept within 200 amperes, the converters are able to deal with it easily, and the difference in voltage is practically nil.

The following figures convey some idea of the growth of the system since 1909, and of the present dimensions of the electric supply undertaking:—

	1909.	1915.
Total number of connections to mains	5,720	16,091
Total number of meters on system ...	5,753	17,350
Total units generated	12,694,367	26,426,072
Maximum load (KW.)	5,400	10,800
Total number of street lamps	5,340	7,000

The monthly load factor, based on the maximum number of units generated in any one hour (usually on Saturday evenings), is approximately 30 per cent. The works costs are approximately .5d. per unit measured by the actual units delivered to the D.C. traction, the three-wire lighting, and to the A.C. bus-bars. This includes a price of 4s. 6d. per 1,000 gallons at present paid for town water. The capital charges on the total power station equipment are approximately .22d. per unit, making a total cost of approximately .72d. per unit generated. The selling prices vary from 6d. to ¾d. per unit.

The department is in a sound financial position; £550,218 has been provided out of profits since 1903-4 (after wiping out losses owing to the gas engine failure during the years 1906-7 and 1907-8). Of this amount £95,227 was utilised for capital moneys, and the remainder went to the relief of rates. The annual amount provided for the above purposes during the last few years has represented some 6 or 7 per cent .of the capital of the whole of the electric supply department, which is approximately £1,000,000 sterling, of which £286,000 belongs to the new steam station plant and buildings, £244,326 is held as an accumulated fund for the redemption of the loans, and there is a net amount of £127,698 still standing to the credit of the renewals fund.

L. & N.W. RAILWAY ELECTRIFICATION.

IN our issue of August 11th we briefly outlined the present position of the work in connection with the electrification of the suburban services of the London and North-Western Railway in the London area.

In this connection we are able to illustrate some of the extensive cable work carried out by Messrs. W. T. Henley's Telegraph Works Co., Ltd., in connection with this scheme, Messrs. Henley having been responsible for supplying and laying the whole of the L.T.-feeder cables, jumper, sectionising, and cross-bonding cables, including some 20 miles of heavy cable.

In addition they provided 12 double-feed switch pillars containing two single-pole 1,500-ampere switches, 22 section double-feed switch pillars, 76 section cross-bond double-feed switch pillars,

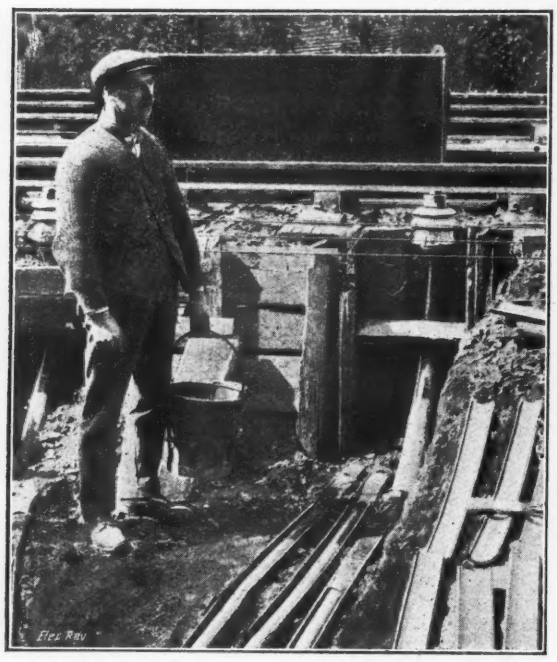

FIG. 1.

and four resistance pillars with 1,500-ampere s.p. switches and resistance grids to carry 3,000 amperes, for 20-second periods at 10-minute intervals.

Fig. 1 shows the laying of 1·25 sq. in. paper-insulated V.B. sheathed track feeder cables at West-End Lane sub-station; the cables pass through an iron bend to make connection with Cortez-Leigh patent sealing terminals; figs. 2 and 3 show section-feeder pillars, in the latter case constructed in concrete near Kentish Town Station on a viaduct, where there was no room for the ordinary type of pillar.

The cubicles are of reinforced concrete, with roller shutters to save space. The cables are 1 sq. in. cross bonding and 1·25 sq. in. section cables, insulated with vulcanised rubber, V.B. sheathed, and laid in shallow troughs, it being impossible to lay the ordinary type of cable in trenches over the viaduct.

Fig. 4 illustrates part of the back of the switchboard in the Willesden sub-station, showing the Henley porcelain sealing ends

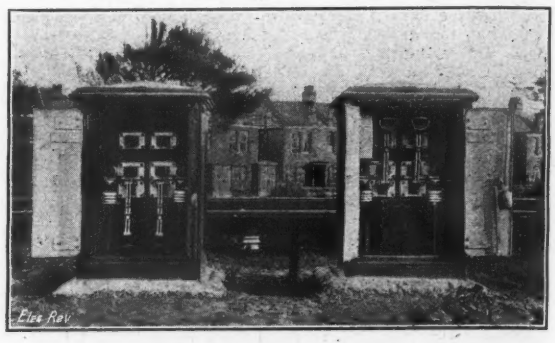

FIG. 2.

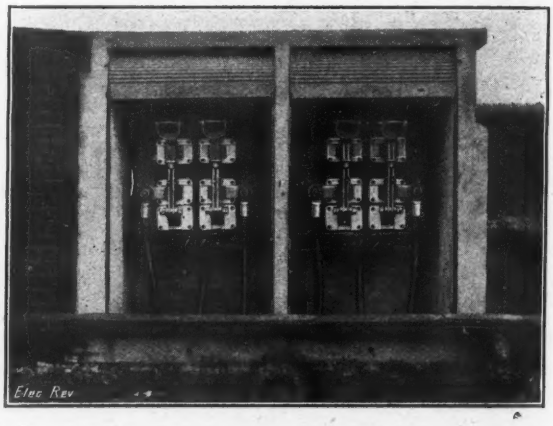

FIG. 3.

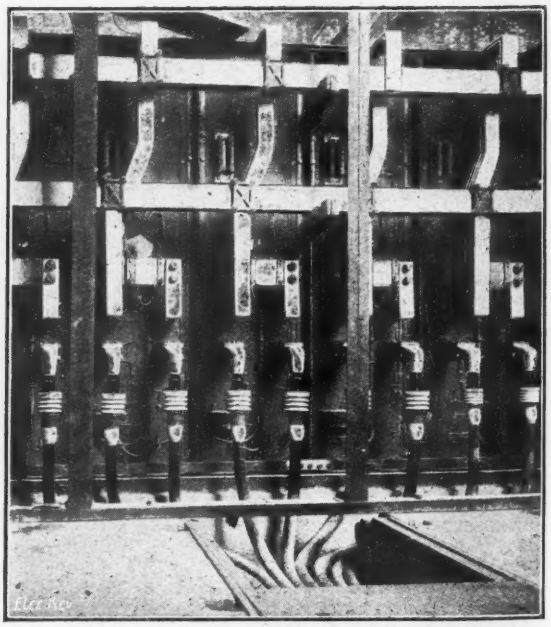

FIG. 4.

with 1·25 sq. in. paper-insulated, lead-sheathed car-shed feeders; the bus-bars are of aluminium.

The cables laid by Messrs. Henley include the sections Willesden to Camden Town, Willesden to Acton Wells Junction, Chalk Farm to Loudoun Road, Chalk Farm to Broad Street, Acton Wells to Kew East Junction—Kew Bridge, and Acton Junction to Gunnersbury.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Raising Steam by Electric Heating.

In many hydro-electric plants there is for some months of the year an excess of energy which is, to a large extent, not utilised. The use of this energy for raising steam in the boilers of a reserve steam plant has naturally suggested itself, and experiments along this line have been made, first, with two steam boilers, by the Electric Supply Co. of Zurich, Switzerland, at its Letten plant. As a result of these tests, the company has ordered two new sets of electric heating elements, for a third boiler, the section of which is given in fig. 1. This apparatus has been in operation since September, 1915.

The electric-heating sets are arranged as shown in the illustration, and consist of resistance elements A of cast iron, insulated with mica and eternit. The use of any easily-fusible or expensive metal or of any solder has been avoided. Each heating unit consists of six resister sets, which may be connected at will according to the particular conditions. The connections are made at the binding posts at the end wall, which also has a window through which the interior may be observed. While electric heating is carried on, the heating chamber is hermetically closed. The

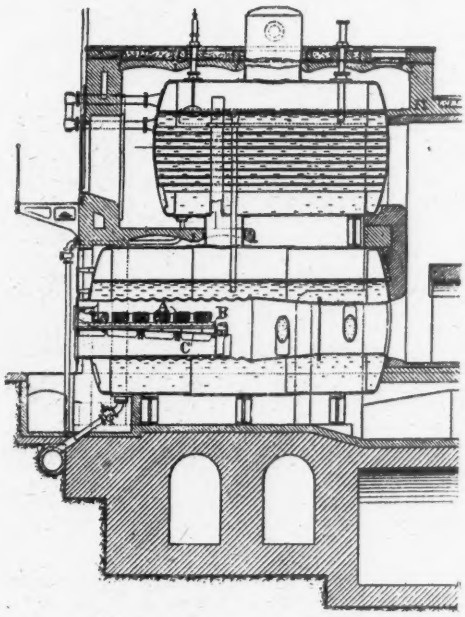

Fig. 1.—Cross-section of Boiler Equipped with Electric Heating Grids (A).

maximum temperature of the heating resisters is below 600° C. The boiler has 180 sq. m. heating surface, and contains 17 cu. m. of water. With a maximum consumption of 84 to 86 kw., 1,720 kg. of steam is produced in 24 hours, and the steam is utilised in various ways. The three boilers of the Zurich station, equipped with electric heating sets, furnish, on the whole, 5,630 kg. of steam per day, with a consumption of 7,392 kw.-hours, saving 750 kg. of coal a day. This is a specific consumption of 1·31 kw-hours per kilogramme of steam (0·6 kw.-hour per lb. of steam).

In order to operate the boiler with coal as fuel, the unit of electric-heating elements is removed from the boiler. This may be easily done in half an hour. The use of electric power for steam raising is proposed only for those periods in which excess power is available whioh would otherwise be wasted.—*Electrical World.*

Fireproofing Manhole Cables.

According to the *Electrical Review and Western Electrician*, the Edison Electric Illuminating Co., of Brooklyn, N.Y., uses concrete to fireproof its lead-covered feeder cables in manholes. Two coats of paraffin, separated from each other by cheesecloth, are applied; a ¼-in. lamp rope is then bound round the cable, and, finally, a ⅝-in. layer of concrete is spread over all. This also prevents the sheaths from picking up stray currents.

Motograph Signs.

The Federal Sign System, of Chicago, U.S.A., is responsible for a new development in moving-sign construction, and what is claimed to be one of the largest electric signs in the world, of this type, is located at the corner of Michigan Avenue and Randolph Street, Chicago, showing in both streets.

The display area measures 130 ft. by 50 ft., and is uniformly studded with 10,000 Mazda lamps, the sockets of which are connected with wires running to a terminal board; by passing a perforated paper ribbon between this terminal board and a corresponding brush-board forming part of the apparatus, lamps corresponding to the perforations are caused to light up on the sign—the effect of moving letters and words being obtained, so that constantly-changing legends can be shown.

The letters in this case are 12 ft. high, and it is estimated that some 200,000 people see the sign each day. At the end of each advertising message, the time of day is flashed upon the sign, with the legend, "Ye Town Clock," and this feature is much appreciated.—*The Central Station.*

A Useful Telephone Attachment.

Fig. 2 shows a new telephone attachment adapted to grip on to the neck of the ordinary desk-pattern telephone. The object of the device is to save the subscriber's time while either waiting for a call or during the delays which so frequently occur when a reference has to be looked up or some other person called to the telephone.

When the receiver is dropped into the two jaws of the "Chatterak" (the name by which this device is known), it lies in a position in which the subscriber, while going on with other work and having both hands free for the same, can hear anyone speaking on the

Fig. 2.—"Chatterak" Telephone Attachment.

line. It is not suggested that this is the most convenient position for carrying on a conversation, although this can be done, and the device used in this way is specially useful when it is desired to take down a message and have both hands free to do so.

The device may be obtained wholesale from the Chatterak Co., of Queen Anne's Chambers, Westminster. The attachment, which costs but little, is finished in copper bronze, similar to the finish most usual on the desk type of telephone.

LEGAL.

Electrical Meters and Machinery Condemned by the Prize Court.

In the Prize Court on August 23rd, the President, Sir Samel Evans, had before him a suit by the Crown, asking for condemnation of a case of "hardware" on the ground that it belonged to enemies of this country.

Mr. M. W. Slade, for the Crown, said that the goods consisted of a case of electrical meters and other machinery, and were shipped on board the British steamship *Michigan*, by Isaria, Ltd., a company incorporated in this country, to customers in Canada, shortly before the war. They were rejected by the customers in Canada and were seized on their return to Liverpool as being enemy property. Isaria, Ltd., had in a letter made a claim to the goods, stating that they were manufactured in Bavaria, the order for them being placed in April, 1914. Accepting their statements, Counsel asked for condemnation on the ground that Isaria, Ltd., was an enemy firm. The facts with regard to Isaria, Ltd., Mr. Slade continued, were set out in his Lordship's judgment in May of last year, in the case of the *Poona*. His Lordship had decided that Isaria, Ltd., must be taken to be a British firm, but following upon the decision of the House of Lords in the Continental Tyre Co.'s case, the company must be regarded as an enemy firm.

The President: Your case is that the goods were the property of Isaria, Ltd., who had not a single British shareholder? You may also say that the order was given to Munich, and that Isaria, Ltd., merely shipped the goods to Toronto?

Mr. Slade: Yes, in which case the goods would be the property of the enemy company in Munich. He added that no formal claim had been put forward to the goods. An order had been made for their sale, but they had not yet been sold.

The President, in giving judgment, said that the company had not put forward any claim to the goods in these proceedings, although they sent a letter to the Procurator-General, alleging that they were the owners, and that as a company registered in this country, they were entitled to have the goods released to them as they were in the case of the *Poona*. In that case he (the President) said that if the judgment of the Court of Appeal in the

Continental Tyre Co.'s case was unsound, it must be so pronounced by the House of Lords. It had been pronounced to be unsound by the House of Lords, and following that decision and his own inclination, as already expressed in the *Poona* case, he must hold that Isaria, Ltd., for all purposes affecting this case, must be regarded as an enemy company, although carrying on business here, and accordingly the goods in question must be condemned as enemy property.

Munitions Court Case.

Before the Monmouthshire Munitions Tribunal, Reginald Victor Powell complained that the Newport Corporation Tramways Department unreasonably refused to issue a certificate in his favour on July 31st. He alleged that he had been superseded as senior switchman by a man who had only been in the Corporation's employment about three weeks, whereas he was a capable man and had been a servant of the Corporation for about 18 months. His application was based wholly upon the fact that the new man had been described as "senior switchboard attendant."

Mr. A. Nichols Moore, the borough electrical engineer, who represented the Corporation, said that the explanation was that both men were senior switchboard attendants.

The application was refused.—*Monmouthshire Evening Post.*

The Thermit Welding Process.

On August 24th, Mr. W. B. Ballantine, of 1, Dr. Johnson's Buildings, Temple, London, E.C., applied for a licence to use two patents in the name of Dr. Goldschmidt, of Essen, for alumino-thermic processes.

Mr. Whitehead, who appeared for Thermit, Ltd., objected to the jurisdiction of the Board of Trade. By agreement the right to these patents was vested in Thermit, Ltd. In July, the Public Trustee, pursuant to an order of the Board of Trade instructing him to sell the shares of Thermit, Ltd., which had hitherto been held by alien enemies, entered into an agreement to sell them to a company known as the Birmingham Metal and Munitions Co., Ltd., and the consideration for sale appeared in the correspondence as £19,500. That money had actually been paid to the Public Trustee, and the shares had been transferred. The bulk of the shares of Thermit, Ltd., were now held by the Birmingham Metal and Munitions Co., a certain number being held by a Mr. Horatio Ballantyne. The Birmingham Metal and Munitions Co., Ltd., was a British company whose shares were held by Nobel's Explosives Co., Ltd., also a British company. It was a matter of the utmost importance to Nobel's Explosives Co., Ltd., and the Birmingham Munitions Co., Ltd., that they should not be deprived of half what they expected was coming to them. There was no indication in the agreement that they were not getting the patents. His clients might desire to go to the Courts for a judicial construction of the agreement.

The hearing was adjourned to decide whether the Board of Trade should assume jurisdiction or not.—*Ironmonger.*

WAR ITEMS.

Employés of Military Age.—A decision was given by the Manchester Stipendiary Magistrate, on August 24th, in a case in which Messrs. Waygood-Otis, Ltd., lift makers, were summoned under the Defence of the Realm Act for failing to post in a conspicuous part of their premises in Manchester a list of their male employés of military age. The defence was raised that the firm was a "controlled" establishment under the Munitions of War Act; that as such they kept at their head office in London a register of all their employés of military age, and that they were accordingly exempt from the obligation to keep a list at the Manchester branch office. The Stipendiary agreed with this view, and dismissed the case.

Separation Allowance Case.—At Bradford, the wife of a soldier, formerly employed in the electricity department, was fined £5 for obtaining money from the Corporation by false pretences. She had applied for relief from the War Fund when her husband enlisted, and stated that he had no allowance from his former employer. On inquiry recently it was found that she had been receiving 14s. a week from the Corporation, as well as the Government separation allowance and 6s. 6d. a week from the War Fund, from which latter she had drawn a total of £20 9s. 6d.

Holborn Tribunal and Electrical Firms.—Mr. Oswald Nettlefold, Chairman of the Advisory Committee of the Holborn Tribunal, has resigned his position in consequence of the Tribunal's decisions in claims made by Messrs. Falk, Stadelmann & Co., and Messrs. J. and W. B. Smith, both engaged in the glass trade in Farringdon Road. The former firm asked for the exemption of 16 men, and the latter for nine. It is alleged that Messrs. Falk, Stadelmann's business has been carried on mainly under the direction of naturalised British subjects of German descent.

The Advisory Committee recommended the dismissal of Messrs. Falk, Stadelmann's appeals, and the granting of Messrs. Smith's, but the Tribunal granted the former firm 13 men of the 16 asked for, and informed Messrs. Smith that six of their men would have two months' exemption, whilst three must join up within three weeks. Mr. Nettlefold accordingly resigned.—*Daily Telegraph.*

Munition Workers' Holiday.—In order to correct a misapprehension which appears to have arisen with regard to the date of the rest period for munition workers, which was directed by the Government, the Ministry of Munitions says it should be understood that the period in question will extend from September 28th to October 1st, both dates inclusive.

German Munitions Captured.—Sir Samuel Evans, sitting in the Prize Court, has condemned as absolute contraband a supply of machinery for munitions and trench-drilling intended for the German forces. The machinery was captured on its way from America, and was made up in 300 small postal packages. It was destined for delivery *via* Copenhagen to the Internationale Pressluft und Elecktricitats Gesellschaft, Berlin.

Training Disabled Sailors and Soldiers.—The Disablement Section of the War Pensions Statutory Committee at a recent meeting discussed a new regulation enabling maintenance to be paid to disabled men during training for employment, in cases where the pension is insufficient to support the man and his family, when the training necessitates absence from home, and thus increases his expenses.

Power Station Fatality.—In connection with a recent Zeppelin raid, an inquest has been held regarding the death of a switchboard attendant, aged 34, employed at a power station. The evidence showed that a bomb dropped in the neighbourhood of the switchboard at about 1.30 a.m., deceased and another man being injured. Medical evidence showed that the man was in a very collapsed condition, suffering from loss of blood, and that he had wounds on the head, chest, and abdomen. He died the next morning from shock and hemorrhage. The jury returned a verdict of death from shock following the explosion of a bomb from a German Zeppelin.

British Industry: Definite Line of Policy Now and After the War.—Mr. F. Dudley Docker has been appointed president, and Sir William Peat chairman, of the Federation of British Industries Association, which has been established as a central organisation of manufacturing interests. Among the bodies which have been absorbed in the new association are the Institute of Industry and powerful industrial groups in Manchester and Birmingham. The Institute of Industry has accordingly gone into voluntary liquidation, a condition being that the minimum amount of the fund to be raised under the new arrangement should be £100,000, a sum which, as a matter of fact, has been greatly exceeded.

A large number of important firms and companies have already given their adhesion to the new movement, which includes a wide representation of all the more important industrial interests in the country. The main object of the new organisation is the investigation and carrying into effect of a definite line of policy in regard to the various matters affecting British industry both now and after the war.

Proposed Ministry of Commerce.—A memorial of the Associated Chambers of Commerce has been submitted to the Prime Minister urging the Government to take immediate steps to create a Ministry of Commerce and Industry with a Minister of Cabinet rank, aided by a permanent advisory council, consisting of representatives of the Foreign Office, the Colonial Office, the India Office, the self-governing Oversea Dominions, and the leading commercial interests of the Empire. The memorial suggests that the Commercial Department, the Patents, Designs, and Trade Marks Department, and the Companies Department of the Board of Trade should form the nucleus of the new Ministry. It is further suggested that commercial representation in foreign countries should be added to the functions of the Commercial Department, with power to send trade representatives to foreign countries in the same way as they now send representatives to British Possessions. The Government is asked to appoint a special committee to inquire into the proposal and to report on it at the earliest possible date.—*The Times.*

British Mannesmann Tube Co., Ltd.—The shares of this company have been sold by the Public Trustee to a British group, including Sir Hugh Bell, Mr. A. J. Dorman, Messrs. Balfour, Williamson & Co., and Messrs. Higginson & Co. All German interest in the company has been eliminated, and it is the intention of the new controlling interests to constitute a representative board to continue the business of the company under the present organisation, which is entirely on a British basis. The company has large weldless-tube works at Swansea, and intends to erect additional tube mills at Newport (Mon.). Other developments are also in contemplation, which will further widen the scope of the company's activity.

The British Mannesmann Tube Co. was registered in July, 1899, as the British Weldless Tube Co., to take over the business of the Mannesmann Tube Co., and four months later the title was altered to its present form. The issued capital is £340,000 in £10 shares, £190,000 being 5 per cent. cumulative preference and £150,000 ordinary shares; in addition £65,500 of 4 per cent. debentures have been issued. The company had a virtual monopoly of the supply of tubes for water-tube boilers, and according to a question by Sir John Lonsdale in the House of Commons, practically the whole of the issued capital was held by persons resident in Germany. Their holdings, in accordance with the provisions of the Trading with the Enemy Act, 1916, were placed in the control of the Public Trustee for disposal, with the result stated above.—*Financial Times.*

Exports to China.—The "London Gazette" for August 29th contains a further list of names of persons to whom articles may be exported in China and Siam.

Metal Workers' Wages.—An application by the metal, wire, and tube workers of Birmingham and district was heard in London by Sir George Askwith, of the Board of Trade. The workmen asked for a 5*s.* war bonus for day workers, and 12½ per cent. increase in pay for piece workers. Sir George heard, too, an application of the engineering and allied trades for a 25 per cent. increase on the present day-work rates. The employers' cases were also presented, and the decisions were deferred.—*Birmingham Daily Post.*

Labour Transfer Scheme.—A scheme for the transfer of skilled labour for accelerating war output has been arranged on the Clyde, and in other Scottish districts, by the Board of Admiralty, the Ministry of Munitions, and the Labour Supply Committee, with the aid of the Boilermakers' Union and the Scottish District and Clyde Committees. It recognises that firms are retaining workmen when their services are not actually required, owing to fear that it would be impossible to secure these men or similar men when their services were most needed. It is thought that if firms were assured that the workmen would be returned to them when required, they would be willing to release the employés to work for other firms urgently needing such men. Therefore a local distributing committee, consisting of representatives of the Admiralty, Ministry of Munitions, and employers' and workers' associations, is to be appointed, with power to ascertain where workmen are available for transfer and where they are needed.

Dilution of Labour.—Dilution has already been established in 150 of the largest of the 300 controlled engineering and shipyard establishments on the Clyde, and some 14,000 women have been introduced by the Commission, the greater proportion of whom are engaged on general engineering work, excluding shells. Agreements have been concluded for dilution in shipbuilding and ship-repairing yards on the Clyde and Tyne with all the principal shipyard trades, and the interchangeability of members of different shipyard trades, and the introduction into the shipyards of unskilled men and women, is proceeding satisfactorily. The work of the Commission on the Clyde and Tyne will be taken over and continued as from September 1st by officers of the Ministry of Munitions and of the Admiralty, as in other parts of the country.

U.S. and Trade After the War.—The New York banking house of Henry Clews & Co., in their weekly financial review, remark: "An interesting feature of our foreign commerce returns for the last fiscal year was that out of total merchandise exports of $4,353,000, more than half, or $2,658,000, consisted of manufactures which doubled their amount in the past twelve months. . . . The extraordinary expansion in manufactured exports is mainly due to the war, and must be considered as quite abnormal. Nevertheless, there is no doubt that we shall retain much of this newly-gained foreign trade, provided our costs can be made to meet those of Great Britain and Germany, who will strenuously endeavour to recover all and more than they have lost. Our chief handicap will be high-priced commodities and labour troubles, in both of which there will have to be a readjustment before we can successfully meet foreign competition abroad."

Exemption Applications.—At Newport (Mon.) Tribunal, Mr. A. Nichols Moore, borough electrical engineer, applied for the exemption of nine men in his department. Mr. Moore pointed out that his department was down to its minimum. The men included men from the permanent-way department, night car repairer, brake fitters, coachbuilder, motor tramways inspector, overhead linesman, &c. All these men were absolutely necessary. Three months' exemption in each case was granted.—*Monmouthshire Evening Post.*

The Stalybridge Tribunal has granted temporary exemption until November 30th (conditional on the men joining a Volunteer Regiment) to three men appealed for by the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways & Electricity Board. It was stated that out of 71 conductors 68 had been allowed to join the Colours, and the Board was contemplating an expenditure of £30,000 on extensions at the generating station. The men appealed for were Mr. S. B. Firth (32, married), cashier, collector and wages clerk; Mr. P. C. Firth (31), chief clerk; and Mr. H. Marsh (33), rent collector and wages clerk. Three members of the office staff had enlisted, and the accountant, who was over military age, had obtained another situation.

Winchcombe Tribunal allowed a month's final exemption to an electrician on a local estate, who also looked after the estate waterworks; he had been passed for garrison duty abroad.

At the York Tribunal, the electricity department applied for exemption for two cleaners and greasers; it was stated that the men were in a certified occupation, and acted as assistant engine drivers. The cases were adjourned for a fortnight. At the same Tribunal, the York Opera House asked for total exemption for its electrician and stage manager, aged 35 and married; after serving seven years in the Army and five years in the Reserve, he was called up for the Expeditionary Force and discharged in February last. Exemption to November 20th allowed.

Before the Bath Tribunal, a further application for exemption in respect of Lawrence Laing, aged 32, electrician at the Palace Theatre, was refused.

On Monday last, at the Westminster Town Hall Tribunal, Mr. H. C. Truman, chief electrical engineer to the Law Accident Insurance Society, was granted exemption for four months as being in a reserved occupation.

The Leeds Tribunal has granted three months' exemption, with leave to renew the appeal, to an electrical and mechanical engineer, who stated that 90 per cent. of his work was in repairing rotary coal-cutting machines.

The Wetherby Tribunal refused to exempt Mr. Edwin Maltby, electrical engineer to Mr. T. G. Mylchreest, of Thorner, who has charge of a private electrical plant supplying a number of residents. He is not to be called up for service before September 15th.

At Hyde, on Wednesday last week, an appeal by George Rutherford, a motorman employed by the Stalybridge, Hyde, Mossley and Dukinfield Joint Board, was disallowed.

At Oldham, temporary exemption was granted until November 1st to an electrician and wireman employed by Mr. Frank Wall; and temporary exemption till December 1st to a pavior in the tramways department, who appealed on domestic grounds.

Watford Tribunal has granted exemption from combatant service to E. Leigh, electric light attendant at Euston Station.

At Blackpool, on August 24th, a firm of electrical engineers, who have lost 17 men out of 21, appealed for an employé, and conditional exemption was granted.

At Cambridge, on August 22nd, an appeal for exemption for Frederick G. Gates (19), electrician, with the Cambridge Electric Supply Co., Ltd., failed. It was stated that the man was "starred," but the Military representative contended that he should be in the Army.

Canterbury Tribunal has given conditional exemption to George Herbert Fowler (28), manager for Mr. E. J. Philpot, electrical engineer.

At Sandwich, on August 23rd, absolute exemption on medical grounds was given to Mr. H. Claringbold (25), electrician.

At Dover, conditional exemption was granted to W. A. King (38), a coal and ash trimmer at the electricity works.

At Deal, Messrs. Stratford & Faulkner appealed for George Ralph (39), electrician, the only workman left, whom they had been unable to replace. Three months were allowed.

At Stoke-on-Trent, on August 24th, the Corporation electricity department appealed for four employés. Mr. C. H. Yeaman, the engineer, said that if the men went he could not be responsible for the supply of current this winter. He had been trusting to the Ministry of Munitions to retain the men, and he had not a single hand who could be spared without jeopardising the supply. It was decided that a list of the employés of the department should be prepared for the Tribunal before the claims were dealt with.

At Caterham, on August 21st, Mr. E. B. Howard, manager of the electricity works, applied for exemption for Mr. A. J. Douglas (40), the only man left to attend to mains, and also acting as shift engineer. The Tribunal, holding that he was in a certified occupation, granted conditional exemption.

Poole Tribunal has given exemption until August 15th to Mr. G. Loveless (35), electrical engineer.

Wallington Tribunal has given conditional exemption to the electrical engineer to a local firm of cement manufacturers.

At Cheltenham, the Military representative asked for the removal of the star against the names of charge engineers at the Corporation electricity works. The electrical engineer (Mr. W. J. Bache) said the works were run in three shifts of eight hours each, and one or other of the three charge engineers was on duty day and night, both week-days and Sundays. The fourth charge engineer was necessary to take the place of any one of the others on leave, &c. He had tried to get men unfit for military service, but had failed. In one case the star was removed, and the other cases were adjourned until two months granted by the Medical Board had expired.

At Wandsworth, Mr. Philpott, of Messrs. Philpott Bros., electrical engineers, of 35, Upper Tooting Road, applied for the conditional exemption of his leading electrician, W. G. Conner. The Tribunal granted three months' exemption on condition that he joined the V.T.C.

Mr. Wild, secretary of the British Incandescent Mantle Co., Ltd., of Ravensbury Road, Earlsfield, S.W., asked for the exemption of a stoker, who, he maintained, was in a certified trade. He had been discharged from the Army after 15 months' service, and applicant did not think he would be called up again. Three months' conditional exemption was granted.

Irish Battery Industry. — According to the *Daily Express*, a factory will shortly be opened in Dublin for the manufacture of dry cells and batteries of all kinds for pocket lamps, telephones, bell and automobile use. It is proposed to start with 200 hands, and an output of about 30,000 batteries weekly is anticipated. The yearly consumption of batteries in the United Kingdom before the war was over 60 millions, most of which wer e imported.

REVIEWS.

Wireless Telegraphy and Telephony. By W. H. Eccles. London: *The Electrician* Printing and Publishing Co., Ltd. Price 12s. 6d. net.

This is a handbook of formulæ, data, and information, and forms an addition to the well-known *Electrician* series of standard electrical works. It is produced in a compact and handy form, well got up and illustrated. There are some 418 pages, with 322 illustrations. In the author's preface the work is described as a classified collection of information, data, formulæ, and tables likely to be helpful to designers and investigators in radio-telegraphy. The information is given in condensed form while yet attempting to set out the position of modern thought and speculation.

The chief divisions of the work fall under the heads of Tables, 52 pages; Formulæ, 63 pages; General Information and Descriptions, 272 pages; Glossary of Terms, 28 pages. In most respects the book is of a comprehensive and informative character, with lucid explanations of the principal features of methods, apparatus, and systems. The tables and formulæ appear to be well selected and useful. In themselves, they convey a large amount of information in tabloid form. Care appears to have been taken to include useful short-cut methods of dealing with electrical problems as, for instance, the equivalent circuit method of dealing with transformer problems where the circuits contain capacity as well as resistance and self-induction. Standard works of reference and original papers have been freely drawn upon in this portion of the book.

The widest scope for comment or criticism falls on the part covering general information and descriptions, where, in the present state of knowledge, it may be expected that much controversial matter will be found. A few of the more salient points presenting themselves in this light will be dealt with here.

In a work of this character, exception may fairly be taken to the perpetuation of weak or misleading methods of expressing ideas. On page 161 appears a table of so-called "ranges" of wireless stations, of typical commercial spark type, in which the ranges corresponding to certain sizes of power plant, wave-length, and nature of transmission surface are given. The mileage figures indicate a professed accuracy of about one per cent. The table is not qualified by any statement as to the nature of the receiver, height and kind of antenna, standard of received signals assumed, standard of hearing assumed, climatic conditions under which tests are taken, standard of sensitivity of auxiliary receiving apparatus, whether day or night signals, and a host of other factors concerned in this absurdly elastic term. That the author is alive to the bearing of some, at least, of these factors is evident from qualifying remarks introduced in a similar connection on pages 324, 327, and elsewhere, but he does not give any hint of the very questionable difficulties to be faced in framing an adequate definition of the term. The suggestion is that its use, at least in the popular sense, should be tabooed in a scientific work. Even more serious exception must be taken to the term being applied, as on page 219, to a form of apparatus for generating high-frequency discharges. Its adoption by international institutions in relation to complete installations may be advanced as an excuse for its perpetuation. So long as such institutions are run and controlled by officials with a smattering of technical knowledge and an absence of practical touch with the subject, and so long as Governments will essay to legislate first and investigate afterwards (or not at all), much time and money will continue to be wasted. A number of the assumptions underlying official essays at wireless legislation are similarly erroneous or unsuitable.

In an interesting dissertation on the theory of propagation of signals round the globe, Dr. Eccles continues to support the contentions of himself and others by the assumption of reflection of electric waves from layers of ionised air having lower boundaries which are "fairly sharply defined," whatever that may mean. Now, the obvious basis for this assumption is the optical condition of a sharply-defined surface of discontinuity between two transparent media upon which total reflection of light depends. It has yet to be shown that a corresponding effect can occur with waves of so grossly greater dimensions than those of light. Also, within what limits is the boundary definition to be taken as "sharp," seeing that waves of the order of a mile or two in length may be concerned, and that, in the optical analogy, sharpness of definition in the wave itself is equally necessary? As at present presented, the assumption can only be taken as a highly speculative one, though Dr. Eccles presents it in so matter-of-fact a way.

The enthusiasm for formulæ evinced by the author manifests itself throughout. Some of these are of doubtful practical value, as in the case of the formula for wave propagation over mountain ranges, given on page 165. This is based purely on wave diffraction, and will, obviously, not account for the large differences in propagation efficiency over mountains by night as compared with daytime.

On the subject of strays, there appears to be a widely-spread fallacy, which is voiced by the author, that strays are largely due to the so-called "silent discharge" of a receiving antenna into the atmosphere. The microscopic currents produced in an antenna by silent discharge under normal conditions cannot account for strays of a strength that matter. If a corona or glow discharge is produced, that is another question; but such discharges are quite abnormal, and even rare, at any rate, in these latitudes.

In reference to quenched spark methods, it is stated that quenching ensures singleness of frequency. This is not a precisely accurate statement, for strongly coupled waves are emitted during the transient building-up process which precedes the quenching of the spark, and this period is not, as a rule, negligible. Neither is it correct to say that mechanical quenching by rotary dischargers gives the equivalent of the usual quenched spark transmission.

Exception must also be taken to the inadequate explanation of the action of Pedersen's ticker receiver, which fails to do justice to this very neat and effective contrivance. A similar remark applies to the theory of the slipping contact detector, and it is not clear why this device is ascribed to L. W. Austin. The drawing of the instrument given on page 340 contradicts the text in an important respect. In regard to the system "Onde Unique," the author states: "There is theoretical reason to credit the claim of single waveness." It has been generally thought that Prof. Howe effectively disposed of this claim. Points in relation to the construction of inductance coils and condensers would bear comment, as also numerous other matters of practical significance.

In the matter of omissions, it may reasonably be urged that the practical working defects and weaknesses of the various appliances and systems are not sufficiently indicated. The trend of developments in Continental practice, especially that of Germany, is not treated nearly as fully as English developments. The important subject of the selection of sites for land stations and the numerous factors involved, as affecting efficiency of operating, running costs, and housing, is not treated. Very little information is given as to mode of emission, propagation, and arrest of waves, such as would lead to good working conceptions of the functions of antennæ both in transmission and reception. Principles of theoretical and practical importance in reference to the effects of varying the proportions of capacity and inductance in high-frequency circuits and antennæ are another matter on which little information will be found. The reader will not gather much knowledge of the organisation of wireless services, or learn that international understandings have been arrived at in regard to the manner and conditions of use of wireless apparatus.

Though a certain amount of criticism has been made, it may be taken that the book contains many desirable features, and will doubtless be much appreciated by engineers and investigators. It fairly presents the prevailing standard of knowledge in wireless telegraphy. That standard cannot be regarded as an eminently satisfactory one, as a great deal of careful investigation and careful weighing of results is necessary to put it upon a satisfactory basis. It will probably be found, in the light of later knowledge, that far too much credence has been given to mis-statements and misinterpretation of results, and that our real knowledge is a great deal less than we are apt to imagine.—J. E. T.

Handbook of Electrical Methods; compiled from the *Electrical World.* London: Hill Publishing Co. Price 12s. 6d. net.

The book before us is divided into ten chapters, surveying the whole of the practical side of what may be called applied electrical engineering. By this we mean that it does not go into questions of manufacture, but of the installation and use of machinery, transformers, switchgear, meters, wiring and apparatus in general.

Though the divisions of the book are called chapters, they are not chapters in the sense that they have been connectedly and consecutively written around the same thread of thought by the same hand. Many hands have written this book, for it consists, as the title tells us, of a compilation of articles from the *Electrical World,* of New York.

As the preface tells us, there is so much of permanent value published in the technical Press, which must, if it is to be of real use, be accessible in some other form. Methodical and probably fussy people mutilate their papers every week, and clip up articles of interest to them in a form of no use whatever to anyone else, and then proceed to hide them where they are of no use whatever to themselves. The orderly carrying-out of this process involves the absence of serious occupation, and its inevitable consequence is that the compiler becomes a serious nuisance to those about him.

The object aimed at, but seldom attained, by such people, is carried out in a proper way with regard to one technical journal in this book. The articles are classified by being reprinted under the chapter heading describing the subject to which they refer.

The subjects dealt with range from thawing frozen water-pipes electrically to replacing insulators on a "hot" 50,000-volt overhead line; from testing electrical instruments to the danger of broken lamps near inflammable material; from an advertising novelty and the method of influencing the curio-seeker's choice to the soldering of "aluminum" and the operation of the "Edison," known here as the three-wire, system.

There are numerous illustrations; we have not counted the number, since nearly all of them appear to be marked Fig. 1. This, of course, arises from the fact that each reprinted article has a Fig. 1 of its own, and the numbering has not been changed.

As a book of reference, the book is useful. It has a good index, and is well printed. It forms an example which might well be followed by papers of similar eminence on this side. The price of 12s. 6d. strikes us as being rather high.

BUSINESS NOTES.

Pumping Machinery in Chile.—U.S. Consul Voetter, at Antofagasta, says that the market for pumps in the district is almost exclusively confined to the requirements of the nitrate plants. In this, the arid region of Chile, there are some 170 plants for the elaboration of nitrate of soda, and each has a pumping installation complete. A nitrate plant uses from 300 to 900 tons of water per day, obtained usually at dug wells located several miles away from the plant. The classes of pumps and pumping machinery used by the nitrate plants are as follows:—

Wells.—Power-driven deep well pumps, usually single-acting, triplex, of bucket type. The depth of well varies from 60 to 500 ft.

Surface force pumps, power driven, for delivery of water from well to nitrate plants. Power is usually furnished from a central electric power station at the plant some miles distant.

Plant.—Boiler feed pumps, almost exclusively steam driven, as also the oil pumps for supplying fuel to the furnaces.

Steam or power driven pumps for transferring liquors (agua vieja) from crystallisation tanks to elevated storage tanks.

From 2 to 10 centrifugal pumps, usually 6-in. suction and 6-in. discharge, for circulating hot liquors (relave) between the boiling tanks. The average centrifugal pump handles from 200 to 400 gallons per minute against a head of 30 ft.

Miscellaneous fire pumps, internal-combustion engine cooling water pumps, fuel-oil pumps, &c.

The general terms of credit given by American manufacturers to importers are cash against shipping documents on arrival of shipment in Antofagasta. European manufacturers extend credit of 60 to 90 days after acceptance of draft against bill of lading on arrival of goods, and in exceptional cases 120 days. Prices should be c.i.f. Antofagasta, and not f.o.b.

Pulley and Belt-Calculating Scale.—We have received a sample of a new calculating scale which has been devised by Mr. H. W. Durham, to assist millwrights, engineers and others to calculate the sizes of pulleys and belts for given powers and speeds, and so on. The scale is published by Messrs. Alfred Haworth & Co., Ltd., price 1s. 8d. post free, and provides for calculations relating to cotton ropes, leather and balata belting, and the sizes of pulleys and gear wheels. It is a useful and handy time-saver.

For Sale.—The Public Trustee invites tenders by September 14th, for the purchase of the whole or any part of the 13,993 £1 fully-paid ordinary shares in the Concordia Electric Wire Co., Ltd., vested in him as custodian by the B. of T., under the Trading with the Enemy Act. Particulars appear in our advertisement pages to-day.

Fire.—A small fire occurred on August 21st at premises at the rear of the establishment of Mr. Edward Pincott, electrician, Alphington Street, Exeter, and damage estimated at between £80 and £100 was done.

Dissolutions and Liquidations.—Heap & Digby.—The partnership between Messrs. A. C. Heap and W. Pollard Digby terminated on the 31st ult. Mr. A. C. Heap has accepted an important appointment which compels him to relinquish all private consulting and inspecting work. Mr. W. P. Digby will continue to carry on the professional work hitherto entrusted to Messrs. Heap & Digby, and will be joined by Mr. Walter Ryley, who has been with them for several years. The title of the new firm will be Digby & Ryley.

Resisto-Electrical Manufacturing Co.—A meeting of creditors will be held at Thorner's Chambers, Ingram Court, 167, Fenchurch Street, E.C., on September 6th.

Phœnix Electric Heating Co., Ltd.—A meeting will be held at 8, Staple Inn, Holborn, on October 2nd, to hear an account of the winding-up from the liquidator, Mr. A. E. Tilley.

Baldur Engineering and Supply Co., Ltd.—The first annual meeting of creditors will be held at 39, Victoria Street, S.W., on September 1st. Liquidator, Mr. J. W. Buck.

Plant for Sale.—The sale of plant and machinery announced in our last issue to take place at Millwall on September 5th, has been postponed to September 13th and 14th.

Catalogues and Lists.—Spray Engineering Co., 93, Federal Street, Boston, U.S.A.—Sixteen-page pamphlet describing and illustrating their "Spraco" system for cooling condensing water, also a folder relating to the Vaughan flow meter.

British L. M. Ericsson Mfg. Co., Ltd., 5, Chancery Lane, W.C.—Leaflets describing a motor-driven telephone generator, and a storage battery hand lamp.

Blacklisted Firms.—A new list of additions to the statutory list of firms of enemy nationality or enemy association with whom persons in the United Kingdom are forbidden to trade has been published. Copies can be obtained from the official publishers.

Australian Postal Contracts. — A discussion is proceeding with reference to the contracts of the Australian Postal department. In October, 1915, the secretary of the Australian Electrical and Allied Contractors' Committee addressed the Postmaster-General, giving reasons why an arbitration clause or its equivalent should be inserted in those contracts. After three months' interval the Postmaster-General intimated that he had decided not to vary the conditions of contract in regard to the rejection of material by making provision for the appointment of a survey board.

Trade Announcements.—The Electric and General Works, Ltd., notify that from September 1st their address will be 128, Stamford Street, S.E. Telephone number: Hop 5223.

Messrs. Woollett, Airey & Co., brokers and shipping agents, have removed their offices to 15, Leadenhall Street, E.C.

"A Question of Origin."—Under this title the Benjamin Electric, Ltd., have just issued a booklet with the object of disproving the supposition existing in some quarters that their products are of foreign manufacture. As we have inspected their workshops, and recently described them in our pages, there is for us no "question of origin"; those who are still sceptical, and are unable to visit the works themselves, will surely be convinced also by a perusal of the contents of this interesting and well-produced brochure.

Change of Name. — With a view to more clearly identifying the company with the place where its works are situated and the nature of the business carried on, Messrs. Thomas Kesnor & Co., Ltd., have, with the approval of the B. of T., adopted the name Watford Electric and Manufacturing Co., Ltd., by which they will be known in future.

Bankruptcy Proceedings.—W. D. Birkett, factor of electrical goods, Whitley Bay. A first and final dividend of 2s. 8½d. in the £ is payable on September 4th, at the Official Receiver's office, 30, Mosley Street, Newcastle-on-Tyne.

Book Notices.—"Polyglot Rubber Trade Directory, 1916." Third edition. New York: *India-Rubber World.*—This publication gives a great deal of information regarding American rubber manufacturers and their products. The opening preface, printed in English, French, German, Italian, Spanish, and Portuguese, gives key letters for rubber goods and imitation rubber products respectively, which are used throughout the several sections to indicate the class of manufactures made by the firms named. The first section is an alphabetical list of rubber manufacturers; the second deals with their products in classified form; others following deal with rubber machinery, tools, and appliances, rubber factory supplies, rubber goods dealers, reclaimers of waste rubber and waste rubber dealers, recent incorporations, and rubber trade marks.

"Canada, the Country of the Twentieth Century." By Watson Griffin. Published by authority of Sir George E. Foster, K.C.M.G., Minister of Trade and Commerce, by the Department of Trade and Commerce, Ottawa. Issued from the Trade Commissioner's Office: 73, Basinghall Street, London, E.C.—The purpose for which this fine volume of between 280 and 290 pages has been produced is to give business men who have never visited the Dominion a comprehensive, but epitomised, review of its agricultural, forest, and mineral resources, its industrial and commercial development, and its geographical relation to the markets of the world. The book is very fully illustrated, with useful maps and with photographic views taken in all parts of the Dominions, contains a record which is both fascinating and impressive to the industrial and engineering mind, and really makes us wonder—the while we study it—why we are here and not there. It is well that we should get to know all we can about this wonderful part of the British Empire, which in these days is contributing so magnificently, by blood and treasure, to the cause of universal freedom. After the war, when Canada resumes those leaps forward which marked her development a few years ago, this record should be of greater interest and value even than it is now.

Proceedings of the American Institute of Electrical Engineers. Vol. XXXV. No. 8. August, 1916. New York: The Institute. Price $1.

"Circular of the Bureau of Standards." No. 56: "Standards for Electrical Service." "Scientific Papers of the Bureau of Standards." No. 281: "A Study of the Inductance of Four-terminal Resistance Standards." No. 283: "Volume Effect in the Silver Voltameter." Department of Commerce: Washington.

"Welfare Work." By E. D. Proud, B.A. With a fore-word by the Right Hon. D. Lloyd George. London: G. Bell & Sons, Ltd. Price 7s. 6d. net.

Les Echanges Franco-Américains. By V. Cambon. Paris: La Lumière Electrique.—In this lecture, delivered to L'Union pour la Belgique et les Pays Alliés, the author discusses the natural resources of the United States, the character of the people, and the business methods which they employ. He then deals with the American products which are destined to replace German imports into France, the artifices adopted in the past by German firms, and the future course of business between France and the United States.

"Electric Switch and Controlling Gear." By C. C. Garrard. London; *Electrician* Printing and Publishing Co., Ltd. Price 15s. net.

LIGHTING AND POWER NOTES.

Australia. — North Shore Electric Supply. — The Sydney City Council has now completed arrangements to connect private consumers in the northern suburbs of North Sydney, Lane Cove and Willoughby across the harbour. The delay in completing the supply scheme was due to war conditions which caused difficulties in securing the necessary material. The supply is 240 volts A.C. 50 cycles for lighting, fans, irons, radiators, and cookers, and 415 volts, three-phase, for motors.

The cable for the supply to Mosmans is expected to arrive at any time.

A hydro-electric scheme is proposed for Warragul (Vic.), from the Tanjil River, 36 miles from the town. It is estimated that it will be possible to supply electricity at about 1d. per unit, and a company is being promoted to carry out the proposal.

The Dimboola (Vic.) Shire Council's electric lighting plant, which has been installed at a cost of £3,750 was formally opened last month; the plant consists of a Hornsby suction gas engine and producer, with generators, and a battery of the D.P. type. The distribution is on the three-wire system at 230 and 460 volts.

In our issue of April 21st, particulars were given regarding the financial position of the Melbourne (V.) City Council's electrical undertaking for the year ended December, 1915. The report of Mr. Harper, the city electrical engineer, which is now available, gives the total units generated as 26,361,637, against 22,806,968 units in the previous year. Of the total units sold, 39 per cent. were for lighting and 60.97 per cent. for power purposes. The number of consumers increased by 717. The total connections for the year amounted to 26,603 KW., as against 24,029 KW. in 1914. Motor connections numbered 3,016, representing 14,668 H.P., as against 2,764 and 13,255 H.P. in 1914. The engineer reports that amongst the inquiries recently dealt with has been one for an electric furnace, which would require a supply of 600,000 units per annum; the maximum demand for 1915 was 8.364 KW., as against 7,751 KW. in 1914; the load factor was 35·7 per cent., as against 30·26 per cent. in 1914. The total working cost for 1915 was ·796d. per unit, as against ·907d. for the previous year, and the total costs, including capital charges, were 1·532d. per unit, as against 1·8d. for 1914, a reduction of 14·8 per cent.—*Commonwealth Engineer.*

Aylesbury.—The U.D.C. has reduced the price of energy supplied to the Royal Bucks Hospital to 2d. per unit.

Baildon.—E.L. Supply.—Application has been made to the Shipley District Council by a number of residents in the adjoining township of Baildon for a supply of electricity, and a reply has been sent that the Shipley Council would be willing to supply under agreement with the Baildon Council, to whom the applicants should apply.

Canada.—A large military camp has been constructed by the Canadian Government at Pine Plains, Simcoe County, Ontario. The camp is 20,000 acres in extent, and has electric power in use for pumping and lighting, the supply being obtained from the hydro-electric line, which runs between Barrie and Waubaushire. A transformer station has been erected at the camp, and the voltage is stepped down from 22,000 volts to 2,000 volts. A number of 150 C.P. gas-filled lamps about 200 ft. apart are placed on the main thoroughfares of the camp, where 300 H.P. is now being taken.—*Canadian Engineer.*

Colombia.—The Municipal Council of Urrao, Department of Antioquia, has been authorised to raise a loan of £8,000 for electric lighting purposes and aqueduct works in the district; the municipal authorities of Amagá, in the same province, are borrowing £1,200 for the installation of an electric-power plant.—*Board of Trade Journal.*

Coniston.—E.L. Scheme Inaugurated.—An electric supply scheme for this parish has been completed, and the light was switched on on August 21st. The supply is by overhead wires to the centre of the area, but it is to be extended to the lower end, and probably to Waterhead. The power station is by the side of a stream, the water of which drives the dynamo. The engineer in charge is Mr. F. Turnbull.

Erith.—Year's Working.—The report of Mr. J. C. Williams, manager of the Council's electrical undertaking, for the year ended March 31st, shows a gross revenue amounting to £32,691, an increase of £8,371; and after deducting working expenses, £22,360, loan charges, £7,139, and other expenditure, there remained a net profit of £1,736, or £250 more than in the previous year. During the year, 5,357,515 units were sold, as against 3,606,336 units in the previous year; the total connections amounted to 3,374 KW. and the load factor to 39·4 per cent. The works and management costs were ·97d. per unit, as against ·9d. in 1914-15; coal cost ·74d., as against ·56d. per unit, but economies in other directions largely counterbalanced this. Mr. Williams remarks that practically the whole of the output was obtained from one turbine set running continuously, a performance which tends to establish confidence in this type of plant. Increased charges (¼d. per unit for lighting and 10 per cent. for power supply) were in force for six months, and brought in an extra £2,279; Mr. Williams hopes that any further increase will be unnecessary.

Glasgow.—Coal Supply.—The question of coal purchases by the Electricity Committee was considered at last week's meeting of the Corporation. A member said that as supplies could not be got from coal owners the Committee had to make purchases from middlemen whose charges were above the rates fixed by the Prices of Coal (Limitation) Act. It had been discovered that the middlemen were exempt from the Act, and an agreement, he alleged, had been come to between owners and merchants whereby a portion of the Corporation's supplies had to come through the latter. Bailie Hannay said that the increased cost was entirely due to the longer distance some of the coal had to be transported.

Kingswinford.—Public Lighting.—The R.D.C. has accepted an offer from the Midland Electric Corporation of a rebate of £151 on the public lighting account, owing to the restricted use of lamps.

London.—A Committee has been formed, consisting of representatives of all the London Borough Councils, 15 companies, and eight municipalities outside the London area, with a view to co-ordinating the existing supply of electricity.

Ormskirk.—Considerable discussion took place at a meeting of the B. of G. on the offer of the Ormskirk Electric Supply Co. for lighting and power. Councillor Richardson moved that the matter be referred back, as they should know exactly what their own machinery could do before it was scrapped. The amendment was defeated, and a recommendation to accept the offer was approved.

Reigate.—At a meeting of the Guardians, last week, a report was considered from a L.G.B. inspector on the question of a proposed laundry extension. The inspector does not regard the installation of electricity as an economical system, seeing that steam power is already in service, notwithstanding that the steam pressure is stated to be insufficient for driving laundry machinery. The views of the Guardians' architects differ on this matter from those of the L.G.B. inspector; they think electricity should be the motive power. The cost of installation would be far less, and with motors, shafting need not be run except when the attached machines are actually in use. The whole matter was referred to the Works Committee.

Sevenoaks.—Fixed-price Lighting.—The U.D.C. has generally approved the adoption by the local supply company of the fixed-priced lighting scheme (as employed in the Wimbledon area), providing that each case of external wiring is separately approved.

Shipley. — Linking-up Proposal. — The Electricity Committee has come to the conclusion that it agrees with the Bradford Electricity Committee that the benefits to be obtained by linking up the systems of the two authorities are not sufficient to justify the proposal being proceeded with.

Stirling.—The T.C. has decided to install an electric elevator in the new municipal buildings in course of erection in Corn Exchange Road, at a cost of £427.

Worsborough.—The U.D.C. has decided to call the attention of the Yorkshire E.P. Co. to the fact that residents in Mount Vernon Road desire to have the electric light installed in their houses, *viâ* the cable of the Barnsley T.C. to Mount Vernon Sanatorium. The company has hitherto refused consent to the supply being taken from the cable.

Worksop.—At the meeting of the U.D.C., on Monday, the Lighting Committee recommended the appointment of Mr. T. R. Skinner as general assistant electrical engineer; Councillor Saxton said that when the Council allowed Mr. J. P. Crowther to join H.M. forces, and agreed to pay him half his salary, it was given to understand that the acting engineer (Mr. Fletcher), whose salary was increased at the time, would be able to manage without extra assistance. Despite considerable opposition, the recommendation of the Lighting Committee was eventually agreed to.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Year's Working.—The report of the year's working of the Corporation tramways to May 31st last shows that the total revenue was £94,328, an increase of £6,326 on the previous year. Working expenses amounted to £58,197, an increase of £6,672, and after payment of £26,432 for interest and sinking fund and other charges, there was a net profit of £9,697, as against £11,000 in 1915. Of this, £3,239 has been allocated to the relief of rates and £6,464 carried to reserve account. During the year, £2,436 was expended out of capital, making a total capital expenditure of £368,769. The depreciation and renewal funds stand at £166,796, the sinking fund at £57,500, and the reserve account at £43,271; making a total of £267,567. Mileage run, 1,968,615, an increase of 59,605 miles. Electricity used, 2,481,384 units, an increase of 164,180 units, at an average cost per unit of ·841d., as against ·845d. in the previous year. During the year 26,593,730 passengers were carried, as compared with 24,048,916 in the previous year.

Argentina. — According to the *Times*, the Central Argentine Co.'s electrified route from Buenos Aires to Tigre was inaugurated on August 25th, by President Plaza. A short description of this scheme appeared in our pages on May 19th last.

Blackburn.—The continual drainage of male employés will probably necessitate a reduction in the tramway service. Before the group system, 115 employés had enlisted; 35 have been

taken under the group system; and there are still 25 liable. Over 20 women are now engaged as conductors, and others for the "collecting" duty and for driving are being trained. The allowances to dependents of men with the Colours amount to £45 per week, and this will shortly be augmented to £60 a week, or £3,000 per annum.

Blackpool.—Holiday Traffics.—It is reported that the tramway receipts during the first fortnight of August were much in excess of those of the same period in 1915, but not up to the record established in 1913; the third week, ending on August 23rd, is reported to have beaten all records.

Electric Vehicles.—The cleansing department has received delivery of a second electric water-sprinkler, purchased at a cost of about £1,000. The two machines will be sufficient to deal with the sprinkling of the streets, and the horsed carts will be withdrawn. One of the water-sprinklers will be used in winter for the conveyance of coke, the Cleansing Committee having decided to have a wagon body built to take the place of the water tank when desired.

Continental.—Italy.—It is announced that a Milan syndicate has submitted a scheme to the Italian Government for the electrification of the railways in Sicily. The necessary energy would be supplied from the power station of the Societa Elettrica dell Sicilie Orientale, the three-phase current being coverted to single-phase current at 50,000 volts at a converter station to be established at Nicosia. The project includes the erection of 14 transformer and distributing stations, where the pressure would be reduced to 11,000 volts.

Spain.—The Sociedad de Tranvias de la Coruna has applied for a concession to construct and work an electric tramway between Coruna and Sada.

Erith.—Year's Working.—The annual report on the Council's tramways shows a total revenue amounting to £21,422; after deducting operating expenses amounting to £15,510, war bonus £2,991, and loan charges £5,206, a net profit of £706 remained. During the year 4,900,811 passengers were carried, an increase of 31·6 per cent., with an additional mileage of 18,471. Mr. Williams, the manager, refers to the exceptionally favourable workmen's fares, and mentions that although 37 per cent. of the total passengers are workmen, only 25 per cent. of the total receipts are derived from them. Fifteen women conductors were employed at the date of the report. The surplus has been placed to reserve.

London Vehicle Charging Stations.—According to the *Motor*, the General Vehicle Co., Ltd., is arranging for a zone of charging stations round London, and other cities.

Manchester.—Up to date, 2,308 employés of the tramway department have joined the Colours.

Oldham.—At a meeting of the Tramways Committee, the manager reported that over 300 miles were lost during the busiest period on the previous Saturday owing to the local horse parade. They had also lost 110 miles during the past fortnight, mainly due to falling guard wires. The guard wires were in a very poor condition, and they were being renewed as quickly as possible.

South Africa.—The Johannesburg T.C. is considering the advisability of adopting a system of workmen's fares on the municipal tramways.

Spanish North Africa.—A concession has been granted to Don Ramon Prendes Rodreguez, for the construction and working of an electric tramway in Melilla.—*Board of Trade Journal.*

Tasmania. — The Minister for Public Works stated recently that the construction of the Huon Railway would be carried out, and he presumed that electricity would be the motive power. Owing to shortage of men the construction could not be proceeded with at once. The route would be *viâ* Kingston, Longley Road, and Crabtree Junction to Huonville.

U.S.A. — Electric Taxicabs. — For some time past electric cabs have been used in Detroit with success. The Detroit Taxicab and Transfer Co. now operates a fleet of 75 electric cabs. The American Motor Livery Co., of Chicago, has recently placed an order with the Milburn Wagon Co. for 12 electric town cars to be delivered November 1st. The new cab will be of the limousine type, and will accommodate five passengers.—*Electrical Review and Western Electrician.*

TELEGRAPH and TELEPHONE NOTES.

Australian Wireless Service Changes.—Some time ago the Commonwealth Government decided to transfer all the work of the wireless branch of the Post Office to the control of the naval authorities. Recently representatives of the Government wireless service waited on the Minister of the Navy to protest against the proposal, which it is contended will result, in some cases, in a loss of social status, less salary, overtime without pay, &c. They also objected to other conditions pertaining to naval control. Wireless employés are to rank in the naval radio service as lieutenants, commissioned warrant officers, warrant officers, or chief petty officers, and will wear the naval uniform of their rank and work under general naval discipline and conditions.

Canadian Telephone Statistics.—The following table shows the capitalisation, cost, revenue, operating expenses, and other data connected with the telephone interests of Canada for 1913, 1914, and 1915:—

	1913.	1914.	1915.
Capitalisation	$59,847,004	$70,291,884	$74,284,991
Cost	$69,214,971	$80,258,356	$83,792,583
Revenue	$14,879,278	$17,297,268	$17,601,672
Operating expenses ...	$11,175,689	$12,882,402	$12,836,715
Remuneration	$6,839,308	$8,250,253	$8,357,029
Number of telephone companies	1,075	1,136	1,396
Wire mileage	1,092,586	1,343,090	1,452,360
Telephones	463,671	521,144	533,090
Employés	12,867	16,799	15,072
Persons per telephone ...	16·2	15·5	15·1
Persons per mile of wire ...	6·8	6·0	5·6

Telephone companies' net earnings in 1915, as represented by the difference between total receipts and operating cost, were $4,764,957. This was better by $350,091 than the result for 1914.

The following are the different classes of organisation:—Government, 4; municipal, 62; stock, 584; co-operative, 601; partnership, 28; private, 117; total, 1,396.

In Manitoba and Alberta practically all telephone interests are in the hands of the local governments. In Saskatchewan, the Provincial Government operates in all the large centres, but has not taken over the 520 small units that spread their wires over the rural sections of the province. In all the provinces there is a growing tendency towards consolidation.—*Electrical Review and Western Electrician.*

Infringement Suit.—The Marconi Wireless Telegraph Co. of America, on July 19th, filed in the Court of Claims a petition against the United States, charging that since June 25th, 1910, the United States, through the Navy and Army Departments and the Department of Commerce, had constructed and used apparatus embodying the inventions covered by four patents, in violation of the rights of the Marconi Co. The Marconi Co. claims damages in the sum of $1,000,000. The patents in question are the following:—

Re-issue No. 11,913 (original No. 586,193, July 13th, 1897), granted to G. Marconi on June 4th, 1901, for transmitting electrical impulses and signals and apparatus therefor.

No. 609,154, granted to O. J. Lodge on August 16th, 1898, for inventions in electric telegraphy.

No. 763,772, granted to G. Marconi on June 28th, 1904, for apparatus for wireless telegraphy.

No. 803,864, granted to J. A. Fleming on November 7th, 1905, for instruments for converting alternating electrical currents into continuous currents.—*T. and T. Age.*

New Zealand's Postal Growth.—Sir Joseph Ward, Postmaster-General for New Zealand, at a recent meeting, gave particulars of the enormous growth of the New Zealand Post Office during the last 25 years; he instanced the fact that in 1891 the number of letters received and dispatched was 75,600, while last year these had risen to 351,000,000. After the war he hoped, he said, that the Post Offices of Australia and New Zealand would direct their combined energies to secure the ideal of sixpence per word cables to Great Britain.

Sweden.—The Swedish Press is urging the Government to take steps to prevent the misuse of the Swedish wireless stations by foreign ships trading in the Swedish waters. It is reported that the telegraph authorities have now taken such measures as will make the use of the Swedish wireless system for trade espionage impossible.

Tesla v. Marconi Co. — The answer of the Marconi Wireless Telegraph Co. to a suit of the Nikola Tesla Co. for an alleged infringement of its patents, was filed recently in the U.S. Federal District Court. The Marconi Co. denied that Mr. Tesla was at any time the original or first inventor of the alleged new and useful method of signalling set forth in the complaint. The answer also denied that the patents issued on March 17th and April 14th, 1903, were duly or lawfully granted to Mr. Tesla, because he had not complied in all respects with the conditions and requirements of the patent laws. The defendant company asks that the complaint be dismissed.—*T. and T. Age.*

West Indies.—A radio station has been installed at Navassa Island lighting station, now under construction; it is operated at present by the contractors for the erection of the lighting station, and will be operated by the United States lighthouse service when the station is completed.—*T. and T. Age.*

Wireless on Ships. — A new regulation under the Defence of the Realm Act specifies that every British ship of 3,000 tons gross tonnage or upwards, in respect of which a licence to install wireless telegraph apparatus has been granted by the Postmaster-General, and which puts to sea from a port in the United Kingdom after a date to be specified in such licence, shall be provided with a wireless telegraph installation, and shall maintain a wireless telegraph service, and shall be provided with a certified operator, together with suitable accommodation for the apparatus and operator. The Postmaster-General will, as and when wireless telegraph apparatus and the services of operators become available for the purpose, cause licences to be issued in respect of such ships as in the opinion of the Admiralty should in the national interests be fitted with such apparatus, and the licences will specify the date as from which the carrying of such apparatus under this regulation is to be compulsory, the character of the apparatus, and the qualifications of the operator.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—September 6th. Powell-Duffryn Steam Coal Co. Electrical goods. Forms from Stores Manager, Aberaman Offices, near Aberdare.

Australia.—SYDNEY.—September 20th. N.S.W. Government Railways. One 50-ton electrically-operated overhead travelling crane for Zara Street power house, Newcastle. October 11th. One motor-driven air compressor for Zara Street power house. Electrical Engineer, 61, Hunter Street.

ADELAIDE.—September 27th. Deputy P.M.G. Telephones, telephone material, instruments and parts. Schedule Nos. 429 to 437.*

PERTH.—October 4th. Deputy P.M.G. Telegraph and telephone measuring instruments and parts. Schedule 501 W.A.*

MELBOURNE.—November 1st. Victorian Railways. 50,000 flame arc carbons. Chief Storekeeper, Railway Offices, Spencer Street.

October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling. Cont. No. 30,343.*

Brighouse.—Electric friction crane complete, to lift about 6 cwt. J. P. Bakeries, Brighouse.

Dublin.—September 6th. G.N. Railway Co. of Ireland. Supply of electric battery material. Specifications from Mr. T. Morrison, Secretary, Amiens Street Terminus.

Edmonton.—September 20th. Electric lamps for six months. Mr. F. Shelton, Clerk, Lower Tottenham.

London.—Supply of electric light fittings for Australia House, Kingsway, W.C. Particulars from Mr. H. H. Turner, 48, Broadway, Westminster, S.W.

Manchester.—September 12th. Tramways Committee. (*a*) Permanent-way special trackwork, and (*b*) permanent-way point tongues and crossings. Specifications, &c. (£1 1s., returnable), Mr. J. M. McElroy, General Manager.

New Zealand. — INVERCARGILL. — September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.*

GISBORNE.—October 2nd. B.C. Cooling tower at the power station. Specifications from the Town Clerk.—*N.Z. Shipping and Commerce.*

Rochdale.—No date. Electricity Committee. 500-K.V.A. static transformer. Mr. C. C. Atchison, Borough Electrical Engineer.

Sheffield. — Water Department. Electrically-driven pump and D.C. motor, &c. General Manager, Water Department, Town Hall.

South Africa.—JOHANNESBURG.—September 4th. Municipal Council. 10,000 drawn-wire metallic-filament traction lamps; 10 miles of 19/14 "Underwriters' wire" (lightly insulated wire for outdoor use). Contract No. 151.*

September 21st. Municipal Council. Tramcar spares. Contract No. 153.*

Spain.—September 25th. Departmento de Fomento de la Mancomunidad de Cataluna, Barcelona, for the installation of a telephone system connecting the towns of Balaguer, Artesa, Pons, and Calaf, at an estimated cost of about £2,850.—*Board of Trade Journal.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aberdeen.—The Tramways Committee has accepted the tender of the British Thomson-Houston Co. for two traction motors, at £115 each.

Australia.—The Nunawading Council has accepted the tender of the Edison Swan Electric Co., at £319, for the supply of consumers' meters in connection with the shire electric lighting scheme.—*Melbourne Age.*

Bury.—The B. of G. has accepted a quotation of the Century Electric Co. for a motor starter for the laundry, and one for a chain drive from Messrs. Hans Renold, Ltd.

Meter Contracts. — Messrs. Chamberlain & Hookham, Ltd., have secured contracts for the supply of electricity meters to Cardiff and Manchester for the ensuing 12 months.

Walthamstow.—The U.D.C. has accepted the following tenders for new plant for the electricity works :—

British Thomson-Houston Co.—Extra-high-tension switchgear, £984.
General Electric Co.—Low-tension switchgear, £135.
Bruce Peebles & Co.—Motor converter, £1,825.

FORTHCOMING EVENTS.

British Association for the Advancement of Science.—Tuesday, September 5th, to Saturday, September 9th. Annual meeting at Newcastle-upon-Tyne. Inaugural meeting at the Town Hall, September 5th, at 8.30 p.m.; address by the President, Sir Arthur Evans, F.R.S.

NOTES.

Education Committees.—In pursuance of the arrangements which the Government has made for reviewing the system of education as a whole, the Prime Minister has appointed two Committees to inquire into the position of science and modern languages respectively in the system of education in Great Britain.

The terms of reference of the Science Committee are :—

To inquire into the position occupied by Natural Science in the educational system of Great Britain, especially in secondary schools and universities; and to advise what measures are needed to promote its study, regard being had to the requirements of a liberal education, to the advancement of pure science, and to the interests of the trades, industries, and professions which particularly depend upon applied science.

Sir J. J. Thomson will be the chairman, as, owing to unforeseen circumstances, Lord Crewe finds that it will not be possible for him to act as chairman of the Committee, as previously announced.

The terms of reference of the Modern Languages Committee are on similar lines.

Communications intended for the committees should be addressed to the secretaries, at the Office of the Board of Education, Whitehall, London, S.W.

London Lights.—A new Lighting Order, more on the lines of the order now existing in the provinces, comes into force in the Metropolitan Police District to-day.

All external lights, whether public or private, must be extinguished with the exception of such public lamps as the Commissioner directs to be kept in use for public safety. All lights not extinguished must be reduced to a minimum intensity, and so obscured that no more than a diffused light is cast on the ground.

Internal lighting must be so reduced or shaded that no more than a dull subdued light is visible from any direction outside, and no part of the pavement or roadway or any building or object is illuminated.

The order will apply to the City of London and the whole of the Metropolitan Police District, and will take effect from 8.0 p.m. from September 1st to 15th; 7.30 p.m. from September 16th to 30th; 6.0 p.m. from October 1st to 15th; 5.30 p.m. from October 16th to 31st; 5.0 p.m. from November 1st until the issue of a further order, till one hour before sunrise in each case.

Electrically-driven U.S. Battle-cruisers.—According to the *Scientific American*, the U.S. Navy Department has decided on the construction of *super* battle-cruisers having a displacement of 40,000 tons and a speed of 35 knots, or 40 miles an hour. These ships are to be fitted with the turbo-electric drive, the 175,000 H.P. required being furnished by four 35,000-KW. turbo-generator sets, which will supply propeller motors, apparently on the lines of equipment fitted to the naval collier *Jupiter* by the General Electric Co. (U.S.A.). The 35,000-KW. sets are 50 ft. 7 in. long, 22 ft. wide, and 15 ft. high, and by placing them on two decks they would occupy a space of only, say, 55 ft. wide by 35 ft. high, by 55 ft. long; if the ships are 850 ft. long by 97 ft. broad, ample space will remain for water-tube boilers and fuel—the latter oil, which can be stored in the double bottom. The engine and boiler plant of the *Lusitania* occupied three-fourths of the ship's length.

Educational Notes.—UNIVERSITY OF LONDON—UNIVERSITY COLLEGE.—The new session of the Faculty of Engineering commences on October 2nd. In addition to the degree and diploma courses, special courses can be arranged, and postgraduate and research work is provided for. A Goldsmid entrance scholarship (£90) will be competed for at the end of this month. See our advertisement pages for particulars.

We have received a copy of the prospectus of the Faculty of Engineering for the new session, giving full particulars of the various courses, &c. Prof. E. G. Coker (Dean) is at the head of the department of Civil and Mechanical Engineering, and Prof. J. A. Fleming (Vice-Dean), of the department of Electrical Engineering.

KING'S COLLEGE, UNIVERSITY OF LONDON.—Faculty of Engineering. Next term begins on October 4th. Particulars are given in our advertisement pages to-day.

LEEDS UNIVERSITY.—Two further gifts of £1,000 each—both anonymous—have increased the Leeds University's special fund for the study of the Russian language and literature for the promotion of British trade to £13,000, and an ambitious scheme is being formulated. It is proposed to have a Russian house arranged and furnished in every detail in the Russian style as the headquarters of the movement in Leeds. The University, having also received a gift of £1,000 to start a fund for a new school of Spanish and Portuguese language and literature, is preparing a scheme for that development also. The idea of promoting British export trade by novel courses of preparatory study is arousing great enthusiasm throughout the West Riding.

On the suggestion of the Ministry of Munitions and the Home Office, two courses of preparation for welfare supervisors in factories have been arranged by Leeds University under the direction of the acting head of the Department of Economics. Under the Police (Miscellaneous Provisions) Act, which came into force on August 3rd, the Home Secretary is empowered to continue in industrial works the welfare supervision now exercised in national munition factories and many controlled establishments. The object of the new University courses is to provide a supply of trained supervisors.

Patents and Alien Enemies.—Application has been made to the Board of Trade to avoid or suspend Patents Nos. 788/06 and 926/06, granted to Goldschmidt for an alumino-thermic process, by W. B. Ballantine. The application of the Suffolk Electricity Supply Co., Ltd., with respect to patent No. 4,908/09 granted to Aust, has been dropped.

Licences have been granted to the Refractory Zinc Ore Treatment Co. in respect of Patents Nos. 605/09 and 15,128/11, granted to Siemens Bros. & Co. and Siemens & Halske, A.-G.

Application has been made to the Board of Trade to avoid or suspend Patents Nos. 19,282/05, granted to Claessen, and 26,322/07, granted to Centralstelle für Wissenschaftlichtechnische Untersuchungen Ges. for aluminium alloys, by Messrs. Vickers, Ltd.

Parliamentary.—The Shropshire, Worcestershire and Staffordshire Electric Power Bill was read a third time in the House of Commons last week.

Scientific and Industrial Research.—The first annual report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1915-16 states that since the establishment of the Committee by Order in Council on July 28th, 1915, it has considered and approved recommendations from its Advisory Council in respect of aid to 20 scientific investigations of industrial importance. It has, in addition, approved grants to a number of individual research workers, both students and others, which will amount at the close of the academic year 1916-17 to a sum not exceeding £6,000. The amount placed by Parliament at its disposal for the initiation of the scheme in the financial year 1915-16 was £25,000, of which £12,241, including a special grant of £4,250 to the Royal Society, was expended in the last months of that year. For the current financial year the vote was £40,000.

A memorandum embodying certain suggestions for promoting co-operation between different parts of the Empire in the organisation of scientific and industrial research was circulated to the Governments of the Dominions overseas, and has been communicated to the Oversea Universities.

The report of the Advisory Council is printed *in extenso*, with five appendices.

Preservation of Trade Union Customs.—Lists of all departures from Trade Union customs under the Munitions Act are being prepared by the Amalgamated Society of Engineers, and similar records are in the possession of the National Advisory Committee and the Ministry of Munitions. The society urges that all such changes should be recorded, because when the time comes for restoration the chief evidence will be the record of departures made by employers and accepted by the Trade Unions as correct. In the instructions to district Committees, it is stated that a complete record of all departures will constitute the most powerful weapon of the society after the war, when grave perils will menace the conditions which have been built up by years of struggle.—*Times.*

Fatalities.—An inquest was held at Newcastle-on-Tyne, on Friday, in connection with the death of Robert Blackburn from injuries received in an electric warehouse lift. It appeared that deceased and another youth went up in the lift to the third story, when the former, who remained in the lift, in some way started it and got jammed between the lift and the side of the well. Deceased was unacquainted with the use of the lift, which in normal times was worked by men. Verdict: Accidental death.

An inquest was held on Saturday last on the body of T. D. Hoskin, aged 23, a gunner in the R.G.A., who was killed by falling from an electric train just before it entered Edgware Road station. The evidence showed that the train was full, and the door of the car was open when it left Paddington, and that Hoskin was pitched out of the car by a sudden jerk. Railway officials stated that the doors were always closed before the train started. The jury returned a verdict of "Accidental death," and expressed the opinion that there had been neglect on the part of the railway officials.

Institution and Lecture Notes.—Institution of Mining Engineers.—The annual general meeting will be held at the Royal Technical College, Glasgow, on Thursday, September 14th, at 11 a.m. A reception by the Lord Provost and Magistrates will take place in the afternoon, and on Friday there will be an excursion down the River Clyde. On account of the war, the usual dinner will not be held.

The Electrical Association of Australia (N.S.W. Section).—The monthly meeting was held at Sydney, on June 2nd. The president, Mr. T. P. Strickland, read a short paper on "Current Rushes in Transformers," and an illustrated lecture was given by Mr. J. J. Richardson, entitled: "The Experimental Electrical Investigations of the late Lord Armstrong on the Characteristics of Positive and Negative Electricity."—*Commonwealth Engineer.*

Iron and Steel Institute.—The autumn meeting of the Institute will be held at the Institution of Civil Engineers, Great George Street, Westminster, on Thursday and Friday, September 21st and 22nd, 1916, commencing at 10.30 a.m. on the 21st and at 10 a.m. on the 22nd.

Amongst the papers that are expected to be submitted for reading and discussion, the only one that appears to be of electrical interest is one by Prof. E. D. Campbell: "Influence of Heat-Treatment on the Thermo-Electric Properties and Specific Resistance of Carbon Steels."

The Council announces that the Privy Council has sanctioned the new by-law providing for the expulsion from the Institute of members who are subjects of a country at war with the United Kingdom.

New Collieries.—It is reported that nearly £1,000,000 is being spent on opening out new coal mines in the Manchester, Leigh, and Bolton districts.

America's Electrical Week.—Information received from the Society for Electrical Development shows that in anticipation of the "electrical week" (December 2nd-9th next) local Committees have been formed in 286 cities; various booklets are to be issued and 25,000 copies of a "Facts" booklet will be distributed, the cover of which will contain a reproduction of the $1,000 prize winning poster, which is to be the official design for the campaign. Nearly 800 designs were submitted for this poster. Amongst other features four weekly magazines, viz., "Collier's," "Scientific American," "Scribner's," and "Leslie's" are to issue special electrical numbers or sections on December 2nd; these publications with nearly 2 million circulation do not overlap to any extent.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place, S.W.—Orders for September, 1916, by Lieut.-Col. C. B. Clay, V.D., Commanding.

A General Parade will be held on Saturday, September 30th, at 2.45, at Headquarters. Uniform.

W. Eyles, Esq. (late R.E.), has kindly consented to give four lectures, as follows:—

Wednesday, September 6th and 13th, "Bridging."
" " 20th and 27th, "Demolitions."

Members are requested to take special note that during this month the lectures will be on Wednesdays, in place of Tuesdays.

Drills will be held under the Sergeant-Major on Tuesday evenings, as during August.

The range will be open on Thursday evenings, as during August.

Instruction Classes at Regency Street will be held as usual for Platoons Nos. 9 and 10.

Entrenching.—Every Sunday at Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m. The importance of a steady continuance of this work cannot be overestimated.

The Commandant desires to draw attention to the Report on Work Done on South London Defences in July, 1916, in which the paragraph referring to the Corps says:—"The work has been very well done and the task completed," and to express his gratification at the support he has received.

Special Note.—Ordinary Drills will be resumed on and after September 18th. Supplementary Orders will be issued later.

Corps Meeting.—A General Meeting will, if possible, be held at the end of September.

MACLEOD YEARSLEY, *Adjutant.*

3RD BATT. (OLD BOYS') CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, August 31st, 1916:—

Week-End Parade.—Saturday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 8.40 a.m., and proceed by train for Entrenching duties. Those who cannot take the early train will parade at 1.20 p.m.

Sunday.—The Battalion will parade at 9.30 a.m. for Entrenching duties.

Recruits.—The O.I.C. will be at Headquarters, Lord's, on Mondays, Wednesdays, and Fridays, to enrol recruits, from 6 to 7 p.m., and to see any members who may wish for an interview.

Recruits will Parade at Lord's Cricket Ground on Saturday, at 3 p.m., and on Sunday at 11 a.m. and 2.30 p.m., for Recruit Drill.

Musketry.—Members who have sent in their names to shoot at Bisley on Saturday, 2nd inst., will report in uniform either to Sergeant J. W. S. Burmester, at 9.20 a.m, at No. 8 Platform, Waterloo Station, or to Corporal W. P. Gibson, at 12.45 p.m., at the same Platform.

Map-reading Class.—Mr. W. Page will commence a new class at Headquarters, at 6 p.m., September 5th. Those who wish to attend should send in their names to the Adjutant as soon as possible.

G. H. F. DUNCAN, *Acting Adjutant.*

Inquiries.—Makers of Davis-Perrett oil eliminating plant, and suppliers of machinery for making paper tubes and troughs, and for pasting paper on iron sheets, are asked for.

Appointments Vacant.—Electrical engineer to take charge of electric lighting and pumping machinery at Roffey Camp, Horsham, Sussex (£3); shift engineer (50s.) and wiremen (38s. to 45s.), for the War Department; shift engineers, for Morley Electricity Works; shift engineer (£2), for Reigate. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Mr. E. C. Goulding, who enlisted as a sapper in the London Electrical Engineers whilst engaged in the Enfield district sales department of the local electric light company, has received a commission in the Mechanical Transport.

The Aylesbury U.D.C. has appointed Mr. W. J. Raby, of Horsham, as assistant engineer at the electricity works at a salary of £2 10s. per week, provided he is exempted from military service.

A presentation was made on August 18th, at the offices of the Guernsey Electric Light & Power Co., to Mr. A. C. Thorn, on the occasion of his approaching marriage.

The *Commonwealth Engineer* mentions that Mr. H. A. Wilcox, manager of the Melbourne Tramways & Omnibus Co., has been appointed manager of the Melbourne Tramway Board at the increased salary of £2,500 per annum. Mr. W. O. Strangward, formerly secretary of the Prahran and Malvern Tramway Trust, has been appointed secretary to the Board at a salary of £1,200 per annum.

General.—Mr. F. J. Borland, of "Scissors" arc lamp fame, and formerly of Leeds, has joined the Italian Red Cross as a motor engineer, and is now on the Italian frontier.

Mr. C. J. Bowen Cooke, chief mechanical engineer of the L. & N.-W. Rly. Co., has just been appointed a Magistrate for the Borough of Crewe.

On the occasion of his marriage, Mr. W. B. Richardson, formerly of the electrical engineering department, G.C. Rly., was presented by the staff of Messrs. Vickers, Ltd. (machine gun shop) with a dining-room clock.

Roll of Honour.—The Distinguished Service Order has been conferred upon Second-Lieutenant (temp. Captain) Hubert Conrad Sparks, London Regiment, for conspicuous gallantry in action. During an assault on the enemy's trenches he took command when his senior officer was killed, and rallied his men, who were under heavy fire, and had expended nearly all their ammunition. With a handful of men he made a most determined stand, although nearly surrounded, and thus enabled the remainder to withdraw. He was the last to leave. Captain Sparks is the brother and partner of Mr. C. P. Sparks, President, I.E.E., whose three sons have also distinguished themselves in the war.

Private W. Ball, Loyal North Lancashire Regiment, who was employed on the Blackpool and Fleetwood Tramways, has been killed in action.

Private Leonard Smith, of the King's Own Royal Lancasters, aged 21, formerly employed on the Blackpool Corporation tramway system, lost his life while attempting to rescue a wounded comrade.

Gunner Herbert Wolstenholme, aged 21, has been killed in action; he was employed at the Accrington Corporation electricity works.

Private H. C. Darbyshire, Royal Fusiliers (Sportsmen's Battalion), killed by a sniper, was formerly employed in the Salford Corporation tramway offices.

Private Harold Peters, South Lancs. Regiment, who is posted as missing, was employed at the British Westinghouse Works, Trafford Park.

Private Ernest Ward, of the Seaforth Highlanders, who has been wounded, was employed by Messrs. T. Harding Churton & Co., Ltd., Leeds.

Private Francis Albert Paskey, of the Royal Fusiliers, who was a partner in an electrical business in London when he enlisted, six months ago, was killed in action on August 6th. He was 28 years of age.

Private H. A. Pickess, Machine Gun Corps, who was with the Southend-on-Sea Corporation tramways, has fallen in action in France. He was 26 years of age.

Sergeant L. Ratcliffe, of the Cheshire Regiment, formerly on the staff of the Mersey Power Co., of Runcorn, has been awarded the Military Medal for bravery at the Front.

Corporal J. Chadwick, of the Lancashire Fusiliers, who served in the South African war, and has seen a good deal of fighting in France recently, has been killed. He was an electrician at Messrs. Bibby & Baron's mill.

Private Herbert Hoyle, of the Lancashire Fusiliers, formerly a motorman employed by the Bury Corporation, has been wounded.

Gunner Vincent Harrison, Royal Field Artillery, formerly in the electrical department of Messrs. Eyre & Sons, Ltd., of Chesterfield, has been killed in action.

Private John Russell, of the Cheshire Regiment, formerly with the Urban Electric Supply Co., Ltd., at Glossop, and the Glossop and Hadfield Tramways, is in hospital.

Private Chas. Edward Firth, of the Yorkshire and Lancashire Regiment, formerly on the staff of the Carlisle electric tramways, has been wounded.

Private Harry Fear, who has fallen in action in France, belonged to Weston-super-Mare, and served his apprenticeship as an electrical engineer at Clifton, Bristol.

Private Fred Beaumont, Gordon Highlanders, who has died of wounds received in action, was on the Halifax Corporation tramway staff.

Corporal J. H. Hull, formerly with the Liverpool Corporation tramways, has fallen in action in France.

Private F. L. Bailey, Barnsley Battalion, formerly with the Barnsley Traction Co., is reported wounded and missing.

Private Owen Alias Jones, Royal Welsh Fusiliers, formerly at the Bangor electricity works, has been killed in action.

Lieutenant Herbert Williamson, who was an electrical engineer at Denaby and Cadeby Collieries, has been promoted to the captaincy, and placed in charge of a machine gun company of the King's Own Yorkshire Light Infantry. At the outbreak of the war he was a lieutenant in the Territorial Forces.

Lance-Corporal William Williams, of the Royal Engineers, formerly electrician at Messrs. Lewis's, Manchester, has been wounded by the accidental explosion of a bomb.

Private Corser, of the Manchester Regiment, an employé of the British Westinghouse Co., has been taken prisoner by the Germans.

Corporal Leslie S. Anderson, of the Manchester Regiment, formerly employed by the Lancashire Electric Power Co., is reported missing.

Gunner Edwin McCullogh (38), of the Royal Artillery Experiments Department, has been accidentally killed while carrying out experiments. He was formerly in the Manchester Corporation tramways department.

Private James Wilkinson, Royal Scots, aged 20, prior to the war an apprentice at the British Westinghouse Works, has been killed in action.

Signaller T. Parker (19), Machine Gun Corps, has been awarded the Military Medal for gallantry in the field. He was formerly employed at the Manchester electricity works.

Captain J. M. Donaldson, of the King's Royal Rifles, whose winning of the Military Cross has just been announced, was educated at the Whitgift Grammar School, Croydon, and won an electrical engineering exhibition of the Fishmongers' Company. He held responsible positions with the British Thomson-Houston Co., and subsequently spent about two years in Canada and the United States gaining experience. Ultimately he became assistant chief engineer to the North Metropolitan Electric Power Co. An old C.L.B. officer, he joined the C.L.B. Battalion of the K.R.R., and went to the Front at the end of November, 1915, being twice slightly wounded ere winning the M.C. for bravery in action.

Private Harold Brewster, of the Lancashire Fusiliers, formerly employed by the British Westinghouse Co., Trafford Park, has been killed in action.

Captain H. G. Fraser, who has been awarded the Military Cross,, was an engineer at the Wakefield Corporation's electricity works.

Sergeant William Conyers, killed in action, was an electrical engineer on his own account in Leeds; he was a son of the late Coun. J. D. Conyers.

Private John Wright, of the Loyal North Lancashire Regiment, who was an employé of Messrs. Dick, Kerr & Co., Ltd., at Preston, is reported from France to be missing.

Private George Lewis, of the Lancashire Fusiliers, posted as missing, was employed at the Salford electricity works.

Captain G. Z. Pinder, of the Canadian Infantry, who, prior to going out to Canada some years ago, was with the General Electric Co., Ltd., Salford, has just been awarded the Military Cross for conspicuous gallantry and ability when leading his Company in a counter-attack, and in subsequently controlling his men when severely wounded.

Acting-Captain Fraser Bryant, of the Manchester Regiment, awarded the Military Cross for conspicuous gallantry and ability, was formerly with Messrs. Mather & Platt, of Manchester. He took command when the Commanding Officer became a casualty during operations, and led with great skill and courage.

Lance-Corporal Joseph Hulme, formerly employed by the British Insulated & Helsby Cables, Ltd., has been awarded the Military Medal for conspicuous bravery. His company officer was wounded, and Hulme went to his aid, and succeeded in getting him to hospital, although under machine-gun fire most of the time. According to a doctor, the officer's life was saved through the prompt treatment he received.

Private Alfred Cornthwaite, Black Watch, has been killed in action; he was formerly employed in the Manchester Corporation tramways department.

Private Harry Hughes, of the Lancashire Fusiliers, formerly employed at the power station at Radcliffe, has been killed in action.

Private Frederick Ireland, of the Royal Scots, wounded by shrapnel and bullets, and now in hospital at Ashton, is only 17 years of age, and enlisted when 16, being then employed at the British Westinghouse Works.

Obituary.—Mr. Walter Stevens.—Mr. Walter Stevens, assistant superintendent of the Western Union Cable Co., at Penzance, has died under distressing circumstances. Deceased was found drowned in the sea at Lamorna.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Resisto Electric Manufacturing Co., Ltd.—Issue on August 4th, 1916, of £1,900 debs., part of a series of which particulars have already been filed.

Holsworthy Gas & Electric Supply Co., Ltd.—Particulars of £750 debs., created July 22nd, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, subject to certain prior mortgages and debentures. No trustees.

Brilliant Arc Lamp & Engineering Co., Ltd.—A memorandum of satisfaction to the extent of £40 on August 19th, 1916, of deb. dated June 22nd, 1915, securing £90, has been filed.

New Peto & Radford Accumulator Co., Ltd.—Mortgage on Victoria Works and Greville Works, Ashstead, to secure £2,000. Holders: C. G. Howard, 16, Tokenhouse Yard, E.C., and C. R. Mayo, 10, Drapers' Gardens, E.C.

CITY NOTES.

West India Electric Co., Ltd.

The report of the president and directors for the year ending December 31st, 1915, submitted at the annual meeting of shareholders held on March 9th, 1916, states that the falling-off in railway receipts which commenced in August, 1914, continued throughout 1915, and showed a total decrease for the year of $22,653.10. The lighting and power receipts, on the contrary, show an increase for the year of $7,886.94. The total receipts from all sources were $274,317.88, as against $288,924.97 for 1914, a decrease of $14,607.09. Fortunately, there was a well-distributed rainfall throughout the year, consequently the consumption of coal was light, and this, in conjunction with other economies, effected a reduction in operating expenses to $143,368.43—a decrease of $11,860.27—the result showing a profit of $130,949.45. There was paid out of this sum interest on bonds, $30,000—payment to the Government of the 4 per cent. tax on railway receipts, $7,409.35—and rental to the Jamaica Light & Power Co., Ltd., $12,000, the total of fixed charges being $49,409.35, leaving a net income of $81,540.10, which has been disposed of as follows: Four quarterly dividends paid amounting to $40,000, transferred to contingent account $17,471.57, and added to surplus account $24,068.53. The contingent fund now amounts to $100,000, and the surplus account to $426,274. Property and plant account has been increased by $25,233.87, made up principally by cost of storage battery and extension of lighting lines. The sale of electric current for lighting and power in Spanish Town has grown slowly but steadily.

Bombay Electric Tramways Co., Ltd.

At the annual meeting, held in Bombay, Sir Sassoon David, the chairman, stated that after meeting all fixed charges, and defraying all the operating expenses and maintenance charges of the business, and making the appropriations to various funds, the balance of net profit justified the declaration of a dividend at the rate of 7 per cent. per annum on the ordinary shares. This left £9,602 to be carried forward, as against a sum of £8,326 brought into last year's revenue. The creation of the Indian board was the result of the action recently taken by a very large majority of the company's shareholders to free it from liability to pay the English income-tax in addition to the Indian income-tax. Not only had the price of materials used in their business in many cases doubled or trebled, but there were great difficulties in obtaining supplies of many articles on any terms whatever. They were anxious as early as possible to place an additional 20 two-car trains on their lines, in order to provide additional accommodation for passengers, but it was quite impossible to say when they would obtain material for the construction of this rolling stock which was on order. The directors' report was adopted, and Sir Sassoon David and Mr. A. H. Froom were re-elected directors, and the election of Mr. F. C. Rimington as a director, during the period he remains in India, was confirmed.—*Indian Engineering.*

Brompton & Kensington Electricity Supply Co., Ltd.—An interim dividend at the rate of 8 per cent. per annum, less tax, on the ordinary shares, payable September 6th, is announced.

Kalgoorlie Electric Tramways, Ltd.—The accounts for 1915, after including the debit balance of £12,520 brought forward and charging £4,000 for depreciation and £9,206 for debenture service, show a debit balance of £18,520 to be carried forward.—*Financial Times.*

South Metropolitan Electric Light & Power Co., Ltd.—Warrants for dividends payable the 31st inst., for the half-year ended June 30th, 1916, of the company's 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares, have been posted.

STOCKS AND SHARES.

Tuesday Evening.

Most of the markets round the Stock Exchange are good in tendency, the immediate cause of the firm tone being the news that Roumania had declared war upon Austria. Upon this, the gilt-edged stocks hardened, and the Home Railway market improved in sympathy. At the end of last week, the latter stocks were decidedly depressed; and the result of this weakness is still seen in some of the Underground issues. Electric lighting shares are steady, and the foreign groups are firm, with the exception of Anglo-Argentine Tramways. Iron, steel, chemical, and rubber shares are mostly better.

London Electric shares, it will be noticed with interest, are unchanged at 1¼ for the ordinary and 4¼ for the preference. County of Londons have risen to 11. The company is doing well, and there are several buyers about of small amounts. Present holders are not disposed to sell, and the limited supply is being easily absorbed. Metropolitans advanced to 2½, showing a rise of ½; and St. James's at 6¼ are 5s. to the good. The Brompton & Kensington Electric Co. has declared an interim dividend at the rate of 8 per cent. on the ordinary shares, payable next week, this comparing with 9 per cent. for the corresponding period last year.

No other quotable changes have occurred, but the market is strong throughout. In explanation, the market offers the well-worn truism that there are more buyers than sellers, but what happens, of course, is that with new issues reduced to something like a minimum, and with so much money being made in the provinces by reason of the war, investors are obliged to confine their attentions to the existing securities and to utilise their money to the best advantage.

The Mexican situation has reached a highly interesting point, but the rise in the various stocks, carried out so sharply last week, suffered something of a check as more cautious views began to take the place of the previous optimism. Previous would-be buyers are reckoning up what it is likely to cost the companies to set their affairs in order; and a little stock has been offered on behalf of those who picked it up more cheaply what time nobody would look at Mexicans. The lighting and power group is very steady, but no further changes have occurred.

In the American-Canadian division, Pennsylvania Water and Power shares are better at 80½, Shawinigan common has risen several points to 136, while Canadian General Electric common fell 1 to 121, the preference being about 119. Vera Cruz Electric Light, Power & Traction fives have been changing hands on the basis of 60. The ordinary shares of the Cordoba Light & Power Co., which are of the nominal value of £1 each, stand about 5s., and are being advised for an advance in price. These shares might be useful by way of a speculative lock-up, but those who buy them should recognise the possibility, to say the least of it, that they may have to keep their holding for several years before the money grows into a profit.

Melbourne Electric ordinary stock has been negotiated during the past few days at about 155½, which is 37 points lower than the price current at the end of July, 1914. Calcutta Electric Supply shares stand at 6½, or £1 less than their pre-war figure. Anglo-Argentine Tramway issues are dull, the first preference again receding 1/16 to 3¾, while the first debenture stock at 75 is a point lower and returns now £6 13s. 4d. per cent. on the money. Brazil Tractions keep steady at 62½, although the report is said to be somewhat disappointing. The preferred shares remain at 93. A feature in this section is the continued strength of British Columbia stocks, further rises occurring of 2 in the preferred and 4 in the deferred, the last-named now being raised to 50.

Metropolitan Consolidated and Districts fell back in sympathy with the weakness of the railway market, to which reference has already been made, but there was a partial recovery, and on balance the falls are trifling. Underground Electric shares are the turn lower, but the 6 per cent. income bonds at 92 gained a small fraction. The bonds will be quoted ex dividend on the Thursday in this week, and, at 89 ex, the return will work out to 6¾ per cent., which is equal to 9 per cent. on the money, if income-tax at 5s. in the £ is taken into account.

Telegraphs have developed a certain amount of irregularity. Eastern ordinary shed a point, and Westerns eased off to 15, while Anglo-American preferred at 103¼ is a shade lower. On the other hand, Cuba Submarines are good at 8½, and Great Northerns rose £2 to 42½. The rise in the latter is associated with the fall in the Petrograd exchange. Telephones are firm, United River Plates gaining ½ at 6½, and Chiles being better at 7. There is not much going on in Globes.

Animation is shown by the Marconi market; and although the parent shares have not moved after their rise of last week,

Americans shot up to 19s. 9d. on buying which was declared to be inspired from the other side. Marconis themselves are being picked up by people who disregard the present paltry yield of 3 per cent. on the money, but who argue that after the war the company will expand its profits and its energies by leaps and bounds.

This, of course, is already discounted to some extent in the price; and it may well be, as we have mentioned on previous occasions, that there will be disappointment when the award of the Government to the company is announced. Some of the people who are following the market rather look for a disappointment of this sort and a consequent drop in price, upon which they expect to get in on a more modest level than 3¼. But as to an ultimate advance in the shares, there are few who have any particular doubt.

The industrial market is keeping up its end with considerable strength. General Electrics are good at 13⅜. The preference are up to their par value of £10. British Westinghouse preference, on the other hand, are a dull market, and at 49s. again show a loss of 1s. Babcock & Wilcox rose 3/16 to 3¼, and nearly all the shares in this section are as nearly buoyant as they can be in the present restricted condition of business, as carried on under the Treasury regulations.

Similar conditions apply to the chemical shares, Castner-Kellners being a leading example at 3¼, at which they are ⅛ up on the week. The rubber market is once more showing noteworthy strength, to which the price of the raw material contributes little or nothing, because after an improvement to 2s. 4½d. per lb., the price went back 1d. per lb. This, however, failed to dissuade the buyers of shares; and once more the familiar complaint is heard that there are not sufficient shares to go round.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price Aug. 29, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6⅜	—	£7 18 2
Charing Cross Ordinary	5	5	3⅛xd	—	7 2 10
do. do. do. 4½ Pref.	4½	4½	3⅛xd	—	6 8 7
Chelsea	5	4	8	—	6 13 4
City of London	9	8	12½	—	6 8 0
do. do. 6 per cent. Pref.	6	6	10½	—	5 14 8
County of London	7	7	11	+ ⅛	6 7 3
do. 6 per cent. Pref.	6	6	10⅜	+ ⅛	5 13 0
Kensington Ordinary	9	7	5½xd	—	6 7 3
London Electric	4	3	1⅜	—	6 10 5
do. do. 6 per cent. Pref.	6	6	4½	—	6 13 4
Metropolitan	3½	3	2½xd	+ ⅛	6 0 0
do. 4½ per cent. Pref.	4½	4½	3⅛	—	7 4 0
St. James' and Pall Mall	10	8	6½xd	+ ¼	6 10 8
South London	5	5	3⅝	—	8 18 10
South Metropolitan Pref.	7	7	1⅜	—	6 4 5
Westminster Ordinary	9	7	6½xd	—	5 14 3
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	103½	— ½	5 16 0
do. Def.	80/-	33/6	29½	—	7 8 9
Chile Telephone	8	8	7	+ ½	5 14 5
Cuba Sub. Ord.	6	6	8½	+ ¼	6 8 6
Eastern Extension	7	8	14⅛	—	*5 7 6
Eastern Tel. Ord.	7	8	148	—1	*5 8 1
Globe Tel. and T. Ord.	6	7	12½	—	*5 8 8
do. Pref.	6	6	10½	—	5 10 4
Great Northern Tel.	22	22	42⅜	+2	5 3 6
Indo-European	13	13	48	—	6 12 8
Marconi	10	10	6¼	—	3 1 6
New York Tel. 4½	4½	4½	99⅜	—	4 10 3
Oriental Telephone Ord.	10	10	2 1/16	—	5 0 0
United R. Plate Tel.	8	8	6⅛	+ ⅛	*5 16 5
West India and Pan.	1	—	1 1/16	— 1/16	—
Western Telegraph	7	8	15	— ⅛	*5 6 8
Home Rails.					
Central London, Ord. Assented	4	4	74	—	5 8 1
Metropolitan	1½	1	24½	— ½	4 1 8
do. District	Nil	Nil	18½	— ¼	Nil
Underground Electric Ordinary	Nil	Nil	1 3/16	— 1/16	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	6	6	92	+ ½	*6 10 5
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	5½	5½	8⅜	— 1/16	7 6 8
do. 2nd Pref.	5½	5½	3	—	—
do. 5 Deb.	5	5	75	—1	6 13 4
Brazil Tractions	4	4	62½	—	6 8 0
Bombay Electric Pref.	6	6	10⅝xd	—	5 14 8
British Columbia Elec. Rly. Pfce.	5	5	68	—	7 7 1
do. do. Preferred	—	Nil	51	+2	Nil
do. do. Deferred	—	Nil	60	+4	Nil
do. do. Deb.	4½	4½	68	—	6 5 0
Mexico Trams 5 per cent. Bonds	—	Nil	42	—	Nil
do. 6 per cent. Bonds	—	Nil	85	—	Nil
Mexican Light Common	Nil	Nil	20	—	Nil
do. Pref.	Nil	Nil	34	—	Nil
do. 1st Bonds	Nil	Nil	42	—	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	3⅛	+ 3/16	4 16 0
British Aluminium Ord.	5	7	26/-	—	5 7 8
British Insulated Ord.	15	17½	12½	—	7 2 10
British Westinghouse Pref.	7½	7½	49/-	—1/-	6 2 5
Callenders	15	20	12½	—	8 8 4
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	20	—	3¼	+ ⅛	5 8 3
Edison & Swan, £3 paid	Nil	—	10/6	—	Nil
do. do. fully paid	Nil	—	1½	—	Nil
do. do. 5 per cent. Deb.	5	5	60	—	8 6 8
Electric Construction	6	7½	17/6	—	8 11 6
Gen. Elec. Pref.	6	6	10	+ ⅛	6 0 0
Henley	20	25	16½	+ ¼	7 11 6
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	12⅜	+ ⅛	*8 5 0
Telegraph Con.	20	20	30	—	*6 4 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 30th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/8	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	,,	£54	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£34	..
a Copper Sulphate	,,	£51	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	122/-	30/- inc.
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	,,	£15	..
a ,, Lump	,,	£12 10	..
a Soda, Chlorate	per lb.	1/1	..
a ,, Crystals	per ton	120/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	1/3⅞ to 1/3	..
c ,, Tubes (solid drawn)	,,	1/3½ to 1/3½	..
c ,, Wire, basis	,,	1/3 to 1/3½	..
c Copper Tubes (solid drawn)	,,	1/6½ to 1/6⅝	..
g ,, Bars (best selected)	per ton	£150	£4 inc.
g ,, Sheet	,,	£150	£4 inc.
g ,, Rod	,,	£150	£4 inc.
d ,, (Electrolytic) Bars	,,	£129	£4 inc.
d ,, ,, Sheets	,,	£147	£4 inc.
d ,, ,, Rods	,,	£136	£4 inc.
d ,, ,, H.C. Wire	per lb.	1/4 5/16	7/16d. inc.
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/3	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/3	3½d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£36	..
g Lead, English Pig	,,	£32 10	30/- inc.
g Mercury	per bot.	£17 12 6 to £17 15	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8	½d. dec.
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	,,	£175 to £175	..
n ,, Wire, Nos. 1 to 16	per lb.	2/10	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Karachi Electric Supply Corporation, Ltd.—At the third annual general meeting of the shareholders it was stated that the demands for the corporation's energy had exceeded all expectations, so much so that the revenue earned in the first year exceeded that which the directors anticipated would be secured during the second year of the corporation's supply to the public. During the twelve months ending March 31st, 1916, 611 consumers were connected with the corporation's mains. The length of mains in the compulsory area, provided for in the licence granted to the corporation by Government, was a little over 12 miles. The one lakh of rupees of capital which the board called up in August last was expended on the extension of the corporation's mains for a further five miles. Many demands for further extensions had been received. The Karachi Municipality had contracted with the corporation for the illumination of a little over six miles of public streets, whilst the Karachi Cantonment Committee had just given the corporation an order to illuminate a little under two miles of streets in cantonments. The directors recommended a dividend at the rate of 5 per cent. per annum. —*Indian Industries and Power.*

Mexico Tramways and Power Bonds.—It is announced that the various meetings of the bondholders of the Mexican Light and Power, Mexico Tramways, Mexican Electric Light, and Pachuca Light and Power Companies will be held on October 4th and 5th in order to consider the past and proposed policy of the Bondholders' Committee and the Trustee. —*Morning Post.*

Davis & Timmins, Ltd.—Interim dividend at the rate of 6 per cent. per annum, free of tax, on ordinary shares, payable September 13th.

Clyde Valley Electrical Power Co.—The directors have declared a dividend of 1¼ per cent. (actual), free of income-tax.

Oxford Electric Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum, less tax, on ordinary shares, payable September 14th.

PETRI PEREGRINI MARICURTENSIS.

Author of "De Magnete" Epistle, A.D. 1269. Originator of the Floating and of the Pivoted Compass.

By P. F. MOTTELAY.

Maricourt, a small village on the right bank of the river Somme, in Picardy, about 8 km. distant from Combles, and 40 km. from Amiens, has of late been in almost daily mention by the general Press,* yet how few readers know it as the birthplace of Petrus Peregrinus, the first-known practical magnetist, author of what is in truth *the very earliest work of experimental science* that has come down to us.

We are told by Roger Bacon ("Opus Tertium," Cap. XI) that Magister Petrus, doubtless a Crusader, was at that time the only one, besides Master John, of London, who could be deemed a thoroughly accomplished, perfect, mathematician, and was one who understood the business of experimenting in natural philosophy, alchemy and medicine better than anyone else in Western Europe. In Chapter XIII of this work, speaking of *scientia experimentalis*, Bacon says:—"I show in the sixth part of my 'Opus Majus' the supreme power of this science over all others that have to be made certain. Students of natural philosophy, commenting upon Aristotle's Meteorlogics, and students of perspective, busy themselves with making these things certain, but in vain; for experience alone here makes certain, and not argument. Accordingly, I require abundance of experiments about those things; and the business of experimenting no one in Western Europe understands, save only Master Peter."

As the work that has made Peregrinus immortal is now of such excessive rarity as to be within the reach of but few, it is thought well to give here some particulars of its very quaint character as well as of its astonishing scope, and to point out briefly the fruitful results of the author's original investigations. These are detailed in a letter, or epistle, "Written in camp, at the siege of Lucera (delle Puglie-Nucerrae), in the year of our Lord 1269, on the 8th of August," addressed to his *amicorum intime*, a soldier, by the name of Sigerus de Foucaucourt.

A translation of the introductory prologue to the work was thus given by the late Prof. Silvanus P. Thompson, in his address before the British Academy, November 28th, 1906:—

> Inmost of friends: being solicited by you, I will disclose to you in rude narration a certain occult nature of the magnet stone. For nothing indeed is pleasurable to philosophers apart from the sharing of the knowledge of it: because the nature of good things wanders and is obscured in darkness until it is brought into the radiance of public recognition. For love of you, therefore, I will write down in plain language things which to the bulk of students are utterly unknown. Nevertheless, we shall not communicate in this epistle any information save about the manifest properties of the stone, on the ground that this teaching will form part of a Tract in which we shall show how to construct physical instruments. To treat of the occult properties of the stone leads us to the art of engraving upon stones. And, although I call those actions manifest concerning which you have inquired, yet they will be of no esteem; and in the eyes of the vulgar will be as illusions and phantasms. And, therefore, because they are secrets to the common people, but will be manifest to astrologers and naturalists, they will also be a solace to them, just as they will likewise be of no slight assistance to travellers who have gone far away.

There are of Peregrinus's work but few reliable manuscript copies, all which have been fully described by Timeteo Bertelli Barnabita, as well as by the late Prof. Silvanus P. Thompson, and there has been of it but one printed issue in book form, that of the Lindau physician, A. P. Gasser, which appeared at Augsburg during 1558.

Much has been said at different times regarding the contents of the above-named epistle, the full title of which is "Epistola Petri Peregrini de Maricourt, ad Sygerum de Foucaucourt, militem, de magnete," and I cannot do better than to give a much abbreviated *résumé* of what will hereafter appear concerning it in my "Bibliography of Electricity and Magnetism." The first part of the work shows, in turn:—

Chapter I.—The occult properties of the loadstone, also the art of making scientific instruments.

Chapter II.—The natures of things and likewise the motions of the heavenly bodies.

Chapter III.—The different requisite qualities of the loadstone, and how loadstones are to be selected and tested.

Chapter IV.—How to find in the loadstone the two poles, using preferably a globular magnet.

Chapter V.—How to distinguish the poles readily:—". . . . the stone in the first vessel will be like a sailor in a ship . . . . if this pole were turned away a thousand times, a thousand times would it return to its place by the will of God."

Chapter VI.—In precisely what manner a magnet attracts a magnet:—"As a rule, the northern part of one stone attracts the southern part of another stone, and the southern the northern."

Chapter VII.—How iron, whenever touched with the magnet, immediately turns towards the poles of the globe.

Chapter VIII.—In what manner a magnet attracts iron. "If violence is used towards the ends . . . . the power in the iron will easily be changed, and that will become southern which was previously northern, and the converse."

Chapter IX.—Why the northern part attracts the southern part and the converse. "The attraction of the south by the south, and of the north by the north, is not according to nature."

Chapter X.—Whence the magnet derives the natural power which it possesses. "It is manifest that the parts of the magnet receive their power from the world's poles . . . the whole magnet from the entire heavens."

The second part of Peregrinus's epistle shows, in turn:—

Chapter I.—*The original construction of the floating compass*, by which the azimuth of the sun and moon and of any star above the horizon, can be ascertained.

Chapter II.—*The original construction of "a better instrument and of more effects," the pivoted compass.* "By means of this, you may be enabled to direct your footsteps to States and to Islands, and to any places on the globe . . . whether on land or on sea, so long as their latitudes or longitudes are known to you."

Chapter III.—The construction of a wheel for perpetual motion. "By making a very thin concave silver case, after the manner of a circular mirror, suitably perforated and around the rim of which are inserted small iron nails, or teeth, bent closely toward each other . . . a magnet being set within . . . so that each tooth of the wheel shall arrive at the North pole; and, owing to the impetus, shall pass by and approach the Southern quarter . . . thus every tooth will be in a perpetual state of attraction and avoidance . . ."

It may be added that to Peregrinus is due the first inception of the *terrella*. He makes the magnet round, and he says: "You must know that this stone bears in itself a likeness of the heavens and contains two points, one north and the other south, thus resembling the poles of the sky." The *terrella* was afterwards constructed in much the same way by Wm. Gilbert, only Peregrinus, as has been said, considered it "a likeness of the heavens," whilst Gilbert regarded it as the earth itself.

In his lecture before the British Academy, Prof. Thompson noted the fact that the pivoted compass of Peregrinus antedates by more than 30 years the date usually given as that of the invention of the mariners' compass by the mythical Flavio Gioja, of Amalfi, in 1302.

* Maricourt lies upon the present south-eastern British Front, and, as we learn from Reports of General Headquarters, it has, during the past six weeks, sustained four very serious German attacks; as many as 300 shells having fallen in one day throughout the village.

THE NIAGARA POWER SITUATION.

For some weeks past our American and Canadian contemporaries have devoted considerable attention to the hydro-electric power situation at Niagara Falls, where there is abundant evidence that the legislative concessions for power development are proving quite inadequate to meet the growing industrial requirements of Canadian and United States users. Indeed, so insistent are the economic demands for extended development of this particular source of power that it would not be surprising were utilitarian considerations to prevail over æsthetic ones in the near future, thus leading to the release of a huge amount of water which has up to the present been reserved with a view to preserving the scenic attractions of the Falls. After all, it needs no great stretch of the imagination to picture a time when, in the absence of cheaper sources of power, the ever-growing demands of human existence will compel the complete utilisation of such a power

source as Niagara. The same thing on a lesser scale occurs almost daily; our cherished hills and woods are surrendered to bricks and mortar, our mountain sides are given up to slate quarries, our fields to coal tips, and our lakes for waterworks reservoirs, and many other instances could be quoted of a similar kind.

At the present time, however, under existing international legislation, it would appear that something like an impasse has arisen. We may remind our readers that by an International Treaty of 1909 between Canada and the United States, the contracting parties agreed that each on its own side of the boundary should have equal and similar rights in the waters defined as boundary waters. If for economic reasons more than half the power is developed on one side, the increment over the half may be regarded as the possession of, and given free entry into, the other country. Under the United States 1906 (Burton) Bill for the control and regulation of the waters of Niagara river and preservation of the Falls, 15,600 cu. ft. per sec. could be diverted from Niagara River on the United States side, exclusive of 10,000 cu. ft. per sec. diverted for the Chicago Drainage Canal. The Boundary Waters Treaty, however, allowed the United States to divert up to 20,000 cu. ft., while Canada can take 36,000 cu. ft. per sec. The Burton Bill allowed an aggregate of 160,000 H.P. to be imported from Canada into the States, under the jurisdiction of the United States Secretary of War, and he, in 1907, allowed "fixed" permits for the International Railway Co. to export 1,500 H.P.; the Ontario Power Co., 60,000 H.P.; Canadian Niagara Falls Power Co., 52,500 H.P.; and the Electrical Development Co., 46,000 H.P. The Act further provided for "revocable" permits for the transmission of additional energy from Canada, the total of all permits, including the 160,000 H.P. mentioned above, and the amount generated and used in Canada, not to exceed 350,000 H.P. A Canadian Act was also passed providing for the exportation of energy to the United States under a duty not exceeding $10 per H.P.-year.

The treaty allowance to Canada of 36,000 cu. ft. per sec. still remains, although the actual power developed has increased. According to the *Canadian Engineer*, certain agreements entered into with the Ontario authorities allow the three large companies operating on the Canadian side to generate an aggregate of 405,000 H.P., which, it is understood, will require the eventual diversion of 29,500 cu. ft. from Niagara River, leaving only the small residue of 6,500 cu. ft. available for further use, or, as our contemporary puts it, for the logical and inevitable expansion of the Ontario Hydro-Electric Power Commission, for it is due to the exceptional growth in the demands of the Commission that the question has been brought into such prominence at the moment.

Quoting our contemporary: "In September, 1910, the Hydro-Electric Power Commission's Niagara system began operations with a load of 600 H.P. That system is now carrying a load of 110,000 H.P. When the Commission executed a contract with the Ontario Power Co. for the supply of 100,000 H.P., it was confidently expected that this amount of power would meet all the requirements of the Niagara system for at least 30 years. The Commission has actually more than exhausted this contract in less than six years' operation, hence the urgent necessity of negotiating the 50,000 H.P. contract with the Canadian Niagara Power Co., concerning which much discussion has recently appeared in the daily newspapers.

"Even upon the basis of the past rate of increase and demand, the Commission will certainly require 200,000 H.P. or more to supply the Niagara system alone in 1918. If this estimate is correct, the extra 50,000 H.P. will be absorbed within a year, and at least two years more will probably elapse before the Commission's Queenston plant will be in shape to deliver power."

The Canadian Niagara Co. exports practically all its power, and is reported to have asked such a high price that the Commission threatened to call in the Dominion Government's aid with a view, if necessary, of curtailing its export of power.

Our contemporary asks whether the contract obligations of the companies are really of such a nature as to make it impossible for them to meet Ontario's demands. The Dominion Government licences are renewable annually, and revocable at will; as recently as 1915 licences in force permitted the power companies at the Falls to export 210,000 H.P. to the States, and it is understood that the companies were specifically cautioned against making binding contracts for the permanent supply of exported power to their American customers in view of the revocable nature of their licences and the possibility of the power being later required in Canada. Moreover, the American users were officially warned by their own Government of the position taken up by the Canadian authorities. In view of this, it is argued that the Canadian Government could not be accused of an unfriendly act if it saw fit to exercise its rights in reclaiming power now being exported.

Such a policy, however, might cause injury to present users of imported power in New York State, where, despite the clearly-defined limitation as to exports, a large vested interest has been created, apparently based on the assumed permanent nature of the supply; actually the New York State Public Service Commission, in a recent discussion, assumed that international relations in regard to the conditions of supply and use of this power had become "fixed," and subject only to changes which would fully protect the interests and rights involved, although the incorrectness of this interpretation of Canadian laws was subsequently pointed out by the Canadian Government.

The position as regards power, light, and heat in Ontario is accentuated because the province is practically dependent on the adjacent coalfields of the United States for its supply of coal, especially of hard coal, which may not always be available in view of the expansion of American industry, and because hydro-electric power is a partial substitute.

Our Canadian contemporary points out that the curtailment or absolute prohibition of export would place New York State in a very similar position to that in which Ontario finds herself at the present time as regards inadequate supply, also that New York State has available a similar remedy to the projected Queenston development by Ontario.

The United States Government still holds in reserve 4,400 cu. ft. per sec. of the treaty water at Niagara. Between 7,000 and 8,000 cu. ft. per sec. of Niagara water is being diverted through the Chicago drainage canal, of which more than 3,000 cu. ft. per sec. is being taken in direct defiance of the Federal authorities at Washington, and is being wasted to all intents and purpose in a low-head development at Lockport, Ill.

New York State should have 7,400 cu. ft. available, and with a practicable head of 300 ft., nearly 225,000 H.P. could be obtained, which would more than off-set the withdrawal of Canadian power.

As regards the proposed Canadian development, the mean difference in level between Lake Erie and Lake Ontario is 327 ft., and the Hydro-Electric Power Commission reports that at least 300 ft. of this head can be effectively used for the development of power through the agency of its projected Chippewa-Queenston scheme. This is more than double the general average of effective head now being used by the power companies at Niagara Falls. It means that with the unallotted surplus of treaty water, the Hydro-Commission can develop nearly 200,000 H.P. at Queenston, or 30 H.P. per

cu. ft. of water as against 14 H.P. which the private companies at Niagara Falls can produce. Moreover, so long at the existing private companies continue to operate on present lines, nearly half a million H.P. will be sacrificed which could be developed for use in Canada.

It may be pointed out that there is no connection between the above scheme (referred to in our "Lighting Notes" on August 20th, 1915) and the Thomson scheme for developing 2,000,000 H.P. by damming the lower Niagara River just above Queenston, which has been much discussed and criticised lately.

On the American side, the representatives of electrochemical industries located at Niagara recently presented their side of the question to members of the Committee on Foreign Relations of the House of Representatives.

One speaker, Mr. F. A. Lidbury, of the Oldbury Electrochemical Co. (says the *Electrical World*), pointed out that ever since power restriction measures came into effect there had been a tendency to shortage of power on the American side and increasing prices, and that this had resulted in the migration of industries to other countries.

The American Cyanamid Co. placed the first fixed nitrogen plant in America on the Canadian side, and was followed by two well-known abrasive industries, which moved the greater part of their furnace operations to Canada, and in one case to France; recently the Union Carbide Co. has been erecting a 100,000-H.P. plant in Norway; and the market for the products of these concerns is principally the United States. It has been suggested that the electrochemical industries could move further west, where there is abundant water power, but Mr. Lidbury pointed out that the market is in the manufacturing districts of the east, and additional transport charges would be prohibitive, calculations showing that in the case of the majority of the processes, they would on the Western Coast require not merely free power, but a bonus equal to what was being paid for power at Niagara.

The power situation was bad, but likely to be worse, as the Canadian Government had reduced the amount of power for which permits were given, and notified its intention to reduce the exported quantities yearly at a rate which would bring exportation to a stop in the course of six or seven years; as at least one-third of the Niagara power used in the States was imported from Canada, they were faced with further restrictions of operations. The speaker went on to urge the complete utilisation of their power resources, and pointed to the enormous industrial developments which had arisen as a result of the alleged spoilage and destruction of the scenic beauty of Niagara.

THE INDUSTRIAL CONDITIONS IN GERMANY IN WAR TIME.

AN interesting survey of the labour and industrial conditions prevailing in Germany in 1915 and early in the present year is contained in a series of Consular reports which have recently been transmitted to the Government of the United States from official representatives in Germany. Under existing conditions official statistics and reports by the German Chambers of Commerce are not being issued, and the information available concerning trade and commerce is therefore fragmentary, and reflects the abnormal period through which German industries are now passing. Consul-General Julius G. Lay, of Berlin, first shows the enormous reduction in the interchange of trade as contrasted with the last year of peace. He states that, as declared at the American Consulates and agencies, the value of the exports from Germany in 1915 amounted to $39,967,000, as compared with $156,406,000 in 1914 and $186,035,000 in 1913. The trade with neutral countries in Europe has materially decreased, largely owing to the embargo, blockade, and contraband restrictions, but that with Germany's allies may be regarded as approaching the normal level.

The large stock of American goods at the free port of Hamburg on the outbreak of war has been absorbed. After the war, Consul-General Henry H. Morgan, of Hamburg, states, a large demand will arise for copper, steel, rubber, &c., in order again to build up the internal industries, and the United States will undoubtedly be called upon to meet these needs. At present, however, there is no possibility of doing business, and the time is not opportune to make any propaganda for the future.

The Consular district of Frankfort-on-Main, which is reported upon by Consul-General Heaton W. Harris, ranks as one of the three principal centres of American trade in Germany. This trade has been for the most part well organised, and formerly covered a wide and increasing range of products, including copper, oils, machinery, leather, rubber tires, calculating machines, &c. Under war conditions, however, this trade has suffered severely. It has been impossible to replenish stocks on account of trans-Atlantic shipping conditions, and several of the agencies have been closed, although the business premises in most cases have been retained for resumption of operations when circumstances permit.

Banking Changes and Company Dividends.

A remarkable feature of 1915, as reported by the Consul-General at Berlin, was the gradual development of the German banks into deposit institutions and the gradual elimination of their stock exchange and commercial characteristics. This alteration was brought about largely by the closing of the Stock Exchange and the limitation of the usual industrial banking activities. The tasks and obstacles confronting the various Berlin banks were essentially the same; the most important task was assisting in the subscription and collection of the war loans. The punctual and creditable operation of these loans is a result which has largely to be credited to the banks. A large increase in investments was also noteworthy during the year, bank depositors becoming to a large extent bank creditors, since the capital that was formerly tied up in commercial pursuits became available. Although the financing of industrial operations almost ceased during the year, it was possible to extend credits in a few cases, as, for instance, in the manufacture of artificial salteptre, yeast, &c.

The annual statements of the most prominent German companies for 1915 show that the number which announced no dividends for the year was relatively small as compared with the total number reviewed. It also appears that a large decrease in dividends was shown only in a minority of cases, and only by undertakings which were either inadequately financed originally or were manufacturing articles of luxury and products intended for exportation. The porcelain and glass industries as well as the potash industry, which generally exported more than half of their production, were naturally compelled to pay lower dividends because the loss of exports could not be compensated in any other way. The cement mills, which were not in the best of positions in times of peace, have suffered greatly.

In general, reduced rates of dividends were reported by the industries not actively engaged in the production of war requirements. The limitation of the output has not only been caused by a decreased demand, but also by a lack of producing facilities. The lines in which relatively high dividends were announced are principally mill products, chemicals, paper, coal, iron and steel, and the textile industries, and the railways and banks also have not materially suffered from the war.

Labour Questions and Increases in Wages.

Since the disturbance in labour conditions which occurred at the beginning of the war, matters have so far improved that the Consul-General at Berlin is able to announce that conditions have now settled down to a degree of regularity. A large amount of female labour has been introduced into various trades where male labour was formerly employed. In a number of industries imported foreign labour, particularly Scandinavian and Dutch, has been substituted for native workers, whilst 650,000 prisoners of war are stated to have already been employed in farming and industrial occupations at the commencement of May, 1916. The authorities in charge of the funds for insurance against sickness continue to report a more favourable situation than in times of peace, and as a result of the employment of men partially incapacitated for military service, and of women, the statistics of the unemployed in the empire have materially improved.

The preliminary figures issued in relation to the number of strikes in the empire in 1915 show a great reduction both in number and duration. As compared with 1914, when 1,115 strikes occurred, there were only 137 last year, and these were generally limited to several factories or firms, but did not extend over a whole branch of industry. Over one half of the strikes were settled by compromise. On the other hand, the number of lock-outs receded from 108 in 1914 to four last year.

Dealing with the state of employment in the province of Rhineland, a report issued for last December by the official Labour Exchanges shows that there were 61 male applicants to every 100 vacancies. Vacancies for 15,453 men arose, but only 9,474 men made applications, and 6,015 of these found occupation. The chief demand came from the agricultural, coal mining, and iron and steel industries. On the outbreak

of the war, 36,800 men out of the total population of 160,750 at Aix-la-Chapelle were engaged in industrial work, but at the end of 1915 only 23,800 were so occupied, indicating a decrease of 13,000 wage-earners.

The manufacturing industries in the Breslau district of Upper Silesia were all affected more or less by the general scarcity of labour, particularly the textile and porcelain trades. On the other hand, the iron and steel branches found means of increasing the number of their employés, first by requisitioning large numbers of Russian prisoners of war, and secondly, by importing labour from the occupied portions of Russian Poland. In addition, large numbers of men were withdrawn from various manufacturing establishments, and their places filled by women and girls, whilst the men themselves were transferred to the iron and steel branches and the machine shops. The entire equipment of manufacturing plants was sometimes changed in order to meet the change of conditions; in other cases extensions were made to accommodate a new branch of the industry, and in other instances it was simply a matter of small details in the construction of machinery and parts. It is possible that the inventions resulting from the war may play an important part in the markets of the world after peace has been restored.

A steady increase in the rates of wages paid since the opening of the war is reported by Consul-General Heaton W. Harris, of Frankfort-on-Main. It amounts to from 20 to 40 per cent., although the actual cost of labour in many industries is said to have been from 40 to 50 per cent. more than previous to the war, in consequence of the employment of many inexperienced workers and the operation of the existing conditions, under which all classes have been more or less affected. Consul William P. Kent, of the Leipsig district of Saxony, adds that it is not expected that the termination of the war will be followed by a reduction in wages to the levels which formerly prevailed, and the prospect of a continued higher cost of labour cannot be disregarded in forming an estimate of German competition in the world's markets. According to Consul Milo A. Jewitt, of the district of Kehl, there is little apparent destitution among the working classes, owing to the adaptation of industries, and the transfer and regulation of labour, together with the national, State, and municipal aid to the needy, especially to the families of soldiers.

The Iron and Steel Branches.

The production of steel throughout Germany and Luxemburg (the Zoll Verein) amounted to 13,187,616 metrical tons in 1915, as compared with 14,946,212 tons in the preceding year, the reduction being ascribed to the labour difficulties. One of the most important events in connection with the industry was the effort made by the Thyssen group to withdraw from the Steel Syndicate) (Stahlwerks Verband). A compromise, however, was arranged, and a reorganisation of the syndicate was rendered unnecessary.

According to the United States Consul at Cologne, the great Rhenish-Westphalian iron and steel region extends into this Consular district, where 19 blast furnaces and several steel plants are situated, most of them in the locality of Coblentz. On the whole, the iron and steel industry of Germany was adversely affected by the war on account of the loss of the foreign market, and the labour shortage due to men having to join the Army. As a consequence, the production of pig iron, which amounted to 19,309,000 tons in 1913, decreased to 14,389,000 tons in 1914, and to 11,790,000 tons last year. A marked revival, however, took place in the production of steel in the second half of 1915, and this has continued, it should be noted, down to July of the present year. The market for iron and steel has been described as active since the latter part of 1915, but no advance in prices occurred until March, 1916. Since then quotations, both for pig iron, semi-finished steel, and sections, have been increased by sums up to 20s. per ton.

Some branches in the district of Aix-la-Chapelle are fully occupied on the production of Army requirements. The gross profits of one of the largest local companies in 1915 were two and a half times as large as in 1914, and a dividend of 25 per cent. has been paid, as compared with 12 per cent. in the previous year. This company succeeded in acquiring large quantities of raw materials before prices reached their present level, and its plant was adjusted from the first day of mobilisation to the production of Army supplies. The plant has been extended, and large Government contracts are on hand. One iron and steel foundry which employs many thousands of workers is operating day and night; whilst another, which paid no dividend for 1914, earned 10 per cent. last year, and smaller foundries and machine shops are also fully occupied.

The adaptation to war production has likewise been carried out in Upper Silesia in such important works as those represented by the Konigs and Laura Hutte, the Bismarck Hutte, the Friedens Hutte, the Borsig Works, the Oberschles. Eisen Industrie, and the Hohenlohe Works, whilst several of the smaller concerns were amalgamated in order to strengthen their interests. All these works are constituents of the Steel Syndicate for semi-finished steel, heavy railway material, and sections.

The Machine and Machine Tool Industry.

If we now turn to the machinery industry, it is found from the report of the Consul-General for Berlin that the conditions in 1915 improved as compared with the previous year, as is shown by an increase in the dividends declared by many prominent companies. The machine tool industry has been able easily to adapt itself to Army requirements; the output has consisted principally of war products, and in a few cases tool-makers have taken up the production of projectiles. Despite the generally satisfactory state of the machine tool industry, complaints were made of the limited supplies of raw metal. In order to remedy this difficulty an office was organised in Berlin to effect the release of the necessary quantities of raw materials, all of which were placed under Government control. Makers' prices of machine tools were raised by 30 per cent., while those of merchants and dealers were increased by 50 to 100 per cent. Since the imports of machine tools from the United States have ceased, makers in the Berlin district report an improvement in the home market, and state that this has afforded partial compensation for their losses in exports. It is added that the scientific training of the leading engineers has been of assistance in facilitating the adaptation to war conditions. The manufacturers of precision machinery have been more affected by the cutting off of the export trade than other branches of the industry.

The great activity of the machinery makers in connection with Army contracts in the district of Aix-la-Chapelle has rendered it impossible for private concerns and the civilian trade to obtain adequate supplies, such as machinery and parts and hardware. In the region of Cologne, the machines made in 1915 were mostly lathes and other tools used in the production of war munitions, and the machine shops are now occupied mainly with the output of munitions. The makers of machinery in Saxony are doing well, and it has been found necessary to work overtime and night shifts, and on Sundays in some cases. The district of Frankfort-on-Main presents similar features, inasmuch as the machine industries in most cases have changed over wholly, or in part, to the manufacture of munitions or other supplies needed by the Army. One well-known company has made material additions to its plant, has operated from two to three shifts, and has paid a dividend of 20 per cent. In the Duchy of Brunswick the large orders from the military and naval authorities have compensated machinery makers for the lack of contracts from foreign countries, and the workmen are kept busy under the changed conditions. The purchase of raw materials was attended with difficulties which delayed the delivery of manufactures, and the advance in the prices of the former and the rise in wages caused the quotations for manufactures to increase. Money conditions were easy, owing to the punctual payment and to war orders. Besides the latter, orders were executed for a number of grain mills, oil mills, storehouses, transport and pneumatic plants and elevators, cement mills, hydraulic presses, and other machinery, whilst potash-nitrogen plants were erected specially for military purposes.

The Electrical Trades.

Dealing with the dividends of German companies, the Consul-General at Berlin mentions that the A.E.G. and the Siemens and Halske Co. have declared rates of 12 per cent. for the business year 1915; the latter reported that its production in that year was about the same as that which obtained in the last few years before the war. The value of the exports invoiced at the American Consulate in Berlin for the United States was only 1,190 dollars in the case of electrical lamps and bulbs in 1915, as compared with 26,265 dollars in 1914, whilst that of all other electrical goods amounted to 35,224 dollars and 18,194 dollars in the two years respectively.

The manufacture of electrical machinery and appliances in the district of Frankfort-on-Main was fairly active in 1915. The electric lighting of villages and of cities has been increasing, partly in consequence of the inadequate supplies of petroleum, and great quantities of small storage battery lamps have been manufactured for the Army. An addition to its works has been made by a large cable and copper working company, with increased earnings, and the dividend paid has been advanced from 7 per cent. in 1914 to 10 per cent. last year.

The industries concerned with porcelain, glassware and pottery in the Breslau district of Upper Silesia suffered more inconveniences owing to the difficulties of export than any other branch of Silesian industries.

The manufactures in the district of Frankfort-on-Main cover a wide range, including dyestuffs and other chemicals, several kinds of machinery and tools, electrical appliances, explosives, copper cable and other copper goods, rubber tires, &c.

The Chemical Industry and New Processes.

The large German chemical companies have been able to declare higher dividends for 1915 on account of their adaptability to war conditions. But the diminution in exports, which formerly represented from one-third to one-half of the total value of the production, is felt throughout the industry. The provision of substitutes for raw materials which were formerly imported has been of great assistance to chemical manufacturers. This has been particularly the case in regard to artificial rubber, albumen, fertilisers, and oil. Military reasons, however, prevent the publication until after the war of reviews of the help rendered by the chemical industry in the production of war materials and pharmaceutical supplies, but it is confidently asserted that the industry has accomplished a great task in these directions. Indeed, it is said that the great home demand has compensated to some extent for the loss of the transmarine export trade. One of the most

surprising changes reported from Upper Silesia is the substitution of cellulose and wood-pulp products for cotton goods.

A further development is announced from the district of Cologne, where several works are stated to have been erected for the extraction of nitrogen from the atmosphere, and the manufacture of fertilisers in place of Chilean nitrates. It is predicted that these works will be able to compete with imported fertilisers after the war.

Apart from synthetic nitrates, substitutes have been needed for cotton in the making of explosives, of artificial camphor and of various other articles. It is possible to read of at least partially satisfactory substitutes for rubber, of the utilisation of the fibre of nettle as a substitute for cotton, of cellulose in the production of string and twine for wrapping and other purposes, and of the food value of certain plants not hitherto used for this purpose. In conclusion, it is mentioned that the general situation has been in part relieved by the large employment of war prisoners in agriculture, together with the more general use of traction engines in ploughing and cutting corn.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Cab Whistles and Lamp Calls.

In your current issue sign-makers and others are invited to "wake up" to the possibility of providing a sign call for taxis, &c. Such a sign, however, has been made and listed by us for some years, the catalogue description of the sign illustrated being:—

"Hotel day and night sign for calling taxi, hansom or four-wheeler. The letter corresponding to the vehicle required is illustrated by a coloured lamp. The letters T. H. F. are shown on three sides."

As the most popular size is fitted with 12-in. opal letters, the sign is visible to drivers of vehicles at a considerable distance. After all, there is nothing new under the "Sun."

The Sun Electrical Co., Ltd.
E. R. MORTON, *Works Manager.*

London, W.C., *August 26th*, 1916.

The Deficiencies of Government Departments.

I read with a considerable amount of interest your leading article, and I must endorse fully all you say as to the difficulty of getting the Government department to work with any serious idea that their department needs to take any business considerations into account.

The following is a short history of an experience with my company:—

We have two lines for telephones to the exchange and a private exchange, from which we have five connections, one of which is to our superintendent of the power-house. In January, 1916, the telephone needed to be moved from the house of the superintendent to another house in a different part of the town In February the telephone authorities were advised where to have this telephone fixed; they were also informed that we were certified under the Ministry of Munitions, and owing to the restrictions of light and other regulations, it was essential that the superintendent should be in telephonic communication with the power-house. After interviews and various correspondence, the company offered temporarily the use of telephone wires on their own trolley wire poles; this proposal was made by the company with a view of meeting the difficulty alleged as being a reason for not being able to fix this telephone—that they had not sufficient labour. I was told by the local representative that they had a regulation that no telephone wires were to be fixed within a certain distance of a tramway trolley wire unless insulated, but as we are working under conditions of "war," it occurred to me that there might be enough commonsense in the subordinates or the chiefs to see that such a ridiculous regulation should be (at least during these times of stress) non-effective; but after nine months of entreaty I have received the following letter:—

"In reply to your letter of the 4th inst. (W.J.S./E.R.M.), I am directed to inform you that the General Post Office have again been communicated with, and a reply to the following effect has been received:—

"It is reported that the offer in question of the electric light company was considered by the Post Office Engineering Department, but that it could not be accepted as the offer involved the use of a pair of wires running on tramway standards which were not properly guarded or protected from the power conductors. The work will be carried out as soon as men are available."

I might for your information inform you that the company's telephone wires are fixed on the tail of the brackets, and, therefore, have the pole in between the trolley wire and these telephone wires, and, furthermore, I don't think there is any place where the trolley wire is within 6 or 8 ft. of the telephone wires.

I think this is a very perfect illustration of the principal objection you raise to Government control.

It apparently does not seem to worry the Post Office authorities that they are under any obligation as a business concern, and that we are put to loss on account of the telephone not being in use, or damage owing to the excessive delay in making this connection.

J. E. Stewart,
Engineer and Manager.

[The article referred to by our correspondent was that entitled "The Centralisation of Electricity Supply" (p. 191), and was written by an engineering contributor.—EDS. ELEC. REV.]

The Electrical Heating of Factories.

In a recent issue of the *Engineering Magazine* (New York) we notice an article by Mr. O. M. Becker on "Factory Efficiency and Heating."

Mr. Becker very rightly contends that the physical environment of the workman directly influences his efficiency, and, consequently, the efficiency of the factory, and then proceeds to argue that to obtain the necessary physical efficiency it is advisable to provide heating for the factory staff by means of exhaust steam.

We are unable to reconcile with his views of efficiency a system which, from an engineering point of view, is equivalent to exhausting into the atmosphere, with the attendant losses, too obvious to need dwelling on. A system which makes the workman efficient to the detriment of the economical running of the steam plant is, surely, no system at all.

However, the point which interests us principally is Mr. Becker's light-hearted condemnation of electrical heating. After casually touching upon one or two extremely antiquated methods of works heating, as still practised extensively, and pointing out their disadvantages, he states that "electrical heating presents the same disadvantages, and, besides, is usually too costly, except under special conditions."

His statement as to electrical disadvantages would require considerable substantiation before convincing anyone who knew anything of modern electric heating, but his article is evidently written with the primary object of boosting that branch of heating in which he is himself interested.

As to the question of cost, Mr. Becker, if he wishes, can easily convince himself that, under modern conditions of generation, electricity can be, and is, supplied in all large industrial centres at rates which render electrical heating a sound commercial and engineering proposition.

The Bastian Electric Co., Ltd.
JAS. BASTIAN, *Sales Manager.*

London, W., *August 25th*, 1916.

To Go—or Not to Go?

I am in an unsettled state of mind as to the course I should now adopt with regard to my future, and accordingly beg to invite your views.

I am an all-round man, *i.e.*, I have had experience in machine shops, power, lighting, telephones, &c., and at present hold the position of foreman of the testing department with a large firm of electrical manufacturers.

I am fair technically, with a *good* commercial experience, of good personality, and a capable interviewer; of sober habits, cool and level-headed; well accustomed to the handling of labour. I have a fair command of the French language.

Summarised: Would it be better to decide to settle in this country or prepare to "get out"?

Wishing your valuable paper the success it deserves, and thanking you, &c.

Unsettled.

[To advise a man on a matter of so tremendous an importance—to him—is difficult and dangerous. Who can tell what the future may bring forth? For ourselves, we have infinite confidence in the ability of the Old Country to weather any storm, and we believe that a period of prosperity lies ahead. We should be very sorry to hear that our correspondent was leaving this country; he is the sort of man who will be indispensable to us when peace returns. Perhaps other correspondents will favour us with their views upon this subject.—EDS. ELEC. REV.]

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ARGENTINA.—The valuations for the purpose of assessing the duties on articles imported into the Argentine Republic are fixed by a Valuation Tariff established in 1906, taken to represent the value of each class of merchandise imported. The Tariff of 1906 classified some 3,700 articles, but it has since been found necessary to value, by analogy, 1,500 other items; and owing to the very considerable changes which have taken place in costs and freights, the present tariff

valuations do not correspond in the majority of cases to actual c.i.f. values.

The question of revising these valuations has been under consideration on several occasions, and a Bill has passed the Senate and been favourably recommended to Congress for the establishment of a permanent Board of Appraisers. Anticipating action by Congress, however, reports H.M. Commercial Attaché at Buenos Aires, the Argentine Government have appointed a Commission, composed of representatives of the Departments of Foreign Affairs, Finance, Agriculture, and Customs, to draw up a revised schedule of valuations for all imports, including those which figure in the Tariff of 1906 and also subsequent additions. Representatives of local industrial, agricultural and commercial interests will also be appointed to the Commission, but will not have the right to vote.

The Commission will collect all data necessary as to the cost and frieght of each article, and will obtain expert technical opinions when necessary.

Fifteen days' notice is to be given of the intention to consider the valuation of specific articles, and after a rate has been provisionally adopted a period of 30 days will be allowed for the presentation of objections, which the Commission will take under consideration before proceeding to make their recommendations.

The Commission will only consider representations which are confined to proving the real c.i.f. value of goods at Argentine ports.

British exporters of merchandise to the Argentine Republic who take exception to the present valuation of their goods for import duty should instruct their representatives in the Republic to bring their views before the Commission.

SOUTHERN RHODESIA.—A Customs Decision has been issued recently to the effect that incandescent bulbs for pocket electric torches are classed under Tariff heading 114B, and accordingly are dutiable at the rate of 3 per cent. *ad val.* under the General Tariff. Goods manufactured within the Empire are, however, admitted free under the Preferential Tariff.

RUSSIA.—A Decree dated June 22nd/July 5th has been published in the official *Bulletin of Laws*, of Petrograd, giving a list of the machines, apparatus, appliances, &c., which are to be admitted, for a period of ten years, free of Customs duties, for the requirements of the Siberian and Ural gold mining industries, in accordance with the Imperial Decree of May 13th/26th last—see the REVIEW of July 14th. The following are included in the list:—

1. Dredges complete.
2. In dredges driven by electricity: dynamos, electric motors with cables and distributing arrangements; protecting and measuring appliances; transformers; electric stations, to be placed on the river bank or in barges and developing power for the engines on the dredge: all steam engines, boilers, motors at the station, electric generators, power conducting apparatus, and in general everything necessary for the fitting up of the station.
3. Parts of dredges, viz. (*f*): parts of electrical equipment for electrical dredges: electric stations on the bank or on a special barge for serving the dredge (engines, dynamos, switchboards, protecting and measuring appliances, transformers, cables, electro-motors).
4. Excavators complete.
5. Parts of excavators, including electric locomotives and parts of same.
6. Appurtenances and mechanism for prospecting dredging areas: including all kinds of drilling apparatus (including those worked by electrical power) with all accessories.
7. Parts of the above-mentioned appurtenances (clause 6), including electro-motors, rheostats, and dynamos.
8. Apparatus, appliances, machines, &c., for crushing gold ores and for extracting from them gold by chemical processes.
9. Parts of above-mentioned apparatus (clause 8).

It is officially announced that the Council of Ministers has approved a proposal submitted by the Minister of Commerce to prohibit the transit through Russia of goods the exportation of which from the Empire is prohibited.

FRENCH INDO-CHINA.—The French Government have notified H.M. Ambassador in Paris that for the period of the duration of hostilities, British goods exported from the United Kingdom to Indo-China, on *British, French or Japanese* vessels, will, in the under-mentioned circumstances, be accorded the Tariff treatment to which they would be entitled if they were transported direct (*i.e.*, they will obtain the benefit of the "Minimum" Tariff rates of duty):—

(*a*) If the goods are dispatched from Great Britain direct or with transhipment in a French port, without subsequent transhipment;

(*b*) If the goods are dispatched from a French port, without subsequent transhipment;

(*c*) If the goods are dispatched from a port in Great Britain, with or without transhipment at Marseilles, but with transhipment at Singapore or at Hong-Kong, subject to the necessary "authorisation" being given by the French Consul-General in London, and provided that the goods are transhipped at Singapore on vessels of the subsidiary line of the Messageries Maritimes, and at Hong-Kong on French vessels. A Consular certificate establishing the regularity of the transhipment must be produced.

(*d*) If the goods are dispatched from a French port with transhipment at Singapore or at Hong-Kong, under the same conditions of transport as are specified in the preceding paragraph, from the port of transhipment to the port in Indo-China.

The Note from the French Government in which this information is conveyed adds that, as the concession is based on the frequent impossibility (under present conditions) of loading British goods on French vessels (for direct transport to Indo-China), the "authorisation" of the French Consul-General in London cannot be dispensed with, and British exporters must, accordingly, obtain such "authorisation" for each consignment of goods.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

11,439. "Adjustable rest for telephone receiver." J. B. BAILLIE. August 14th.
11,453. "Clips or gripping appliances for moving traction cables, endless rope systems, &c." A. PARRY. August 14th.
11,465. "Telegraphy." E. S. HEURTLEY. August 14th.
11,503. "Electric cable connecting boxes, fuse switch boxes, dividing boxes, &c." R. W. BLADES AND BRITISH INSULATED & HELSBY CABLES, LTD. August 15th.
11,520. "Apparatus for closing and locking gates, &c., by electrical means." J. P. SCOTT. August 15th.
11,533. "Selenium cell." ECONOMIC CAR LIGHT, *LTD.*, & W. W. LEWIS. August 15th.
11,537. "Apparatus for signalling or telegraphing." T. MCLEOD. August 15th.
11,548. "Spark plugs." G. J. KNUTSON. August 15th.
11,564. "Electro-magnetic pneumatic furnace." A. TURNER. August 16th.
11,565. "Fluid containers or holders, and fabrics for same." BRITISH INSULATED & HELSBY CABLES, LTD. August 16th.
11,569. "Contact breakers for magnetos, &c." H. KEEN. August 16th.
11,581. "Electric lamps." F. WESTWOOD. August 16th.
11,604. "Automatic and semi-automatic telephone systems." W. AITKEN AND THE RELAY AUTOMATIC TELEPHONE CO. August 16th.
11,605. "Automatic and semi-automatic telephone systems." W. AITKEN AND THE RELAY AUTOMATIC TELEPHONE CO. August 16th.
11,617. "Electrically-operated indicator mechanism." W. R. SYKES INTERLOCKING SIGNAL CO. & R. W. TARRANT. August 16th.
11,623. "Electric furnaces." SOC. ELECTRO-METALLURGIQUE FRANCAISE AND D. F. CAMPBELL. August 16th.
11,643. "Sparking plug for internal-combustion engines." J. KNIGHT. August 17th.
11,658. "Means for telephonic communication to and from moving railway trains, &c." K. H. WARFVINGE & V. G. WERNER. August 17th. (Sweden, August 27th, 1915.)
11,683. "Ships', &c., electric telegraphic apparatus." C. H. WOODWARD AND W. CHADBURN. August 17th.
11,684. "Submarine electric leakage telegraphy." SIGNAL GES. August 17th. (Germany, March 16th, 1915.)
11,691. "Magneto-ignition systems." SOC. DE PARIS ET DU RHONE. August 17th. (France, December 6th, 1915.)
11,707. "Ships' pneumatic telegraphic apparatus." W. CHADBURN. August 18th
11,713. "Electric lamp holders." BIRMINGHAM ELECTRICAL ACCESSORIES MANUFACTURING CO. & C. E. GARRETT. August 18th.
11,736. "Pocket or portable electric lamp." W. KING & B. THEODOR. August 18th.
11,740. "Prepayment electricity meters." LANDIS & GYR SOC. ANON. August 18th. (Switzerland, September 18th, 1915.)
11,743. "Ignition systems for internal-combustion engines." F. HOLDEN. August 18th.
11,752. "Electric motor gyroscopes." CRUCIBLE STEEL CO. OF AMERICA. August 18th. (U.S.A., April 3rd, 1915.)
11,769. "Electric motor gyroscopes." CRUCIBLE STEEL CO. OF AMERICA. August 19th. (U.S.A., November 3rd, 1915.)
11,787. "Sparking plugs for internal-combustion engines." W. A. CLARK, H. C. LONGFORD, W. W. LONGFORD & THE SPHINX MANUFACTURING CO. August 19th.
11,789. "Electric transformers." BRITISH ELECTRIC TRANSFORMER CO. AND S. C. MOUNT. August 19th.
11,804. "Varying frequency of alternating electric currents." A. ROLFE. August 19th.
11,807. "Producing electric oscillations." R. E. GILLMOR (Sperry Gyroscope Co.). August 19th.
11,812. "Electric lifting magnets." A. WEST AND A. WEST & CO. August 19th.

PUBLISHED SPECIFICATIONS.

1914.

15,690. ELECTRO-MAGNETIC FRICTION CLUTCHES. J. Bing. June 30th.

1915.

6,408. DRIVING AND REGULATING OF TALKING MACHINES. British Thomson-Houston Co. (General Electric Co., U.S.A.). April 29th.
8,537. ELECTRICAL HEATER. W. J. Kerr. June 9th. (December 7th, 1915.)
11,321. STARTING AND SYNCHRONISING OF DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. & F. P. Whitaker. August 5th.
11,976. TELEPHONE TRANSMITTERS. J. Liddle (Universal High-power Telephone Co., U.S.A.). August 19th.
12,075. SEALING MEANS, MORE PARTICULARLY FOR USE IN CONNECTION WITH ACCUMULATOR CASES. C. A. Vandervell. August 21st.
13,934. OPERATING ROTARY CONVERTERS AND OTHER ALTERNATING-CURRENT MACHINERY. A. H. Railing & C. C. Garrard. October 1st. (Patent of addition not granted.)
14,993. MAGNETO-ELECTRIC MACHINES FOR IGNITION IN INTERNAL-COMBUSTION ENGINES. M. S. Conner. October 23rd.
15,873. SPARKING ARRANGEMENTS FOR ELECTRIC IGNITION DEVICES. H. W. F. Ireland. November 10th.
17,910. CONSTRUCTION OF SPARKING PLUG FOR INTERNAL-COMBUSTION ENGINES. A. E. Heath. December 22nd.

1916.

3,707. SYSTEMS FOR THE PROTECTION OF ELECTRIC CABLES IN THE EVENT OF EXTERNAL DAMAGE. C. J. Beaver & E. A. Claremont. March 13th. (Addition to 6,674/15.) (100,978.)
5,061. TELEPHONE INSTRUMENTS. E. A. Petithory. April 6th, 1916. (100,987.)